The Society is not responsible, as a body, for the statements and opinions advanced in this publication.

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This Issue Contains

NEWS ABOUT THE SOCIETY AND ITS COMMITTEES:

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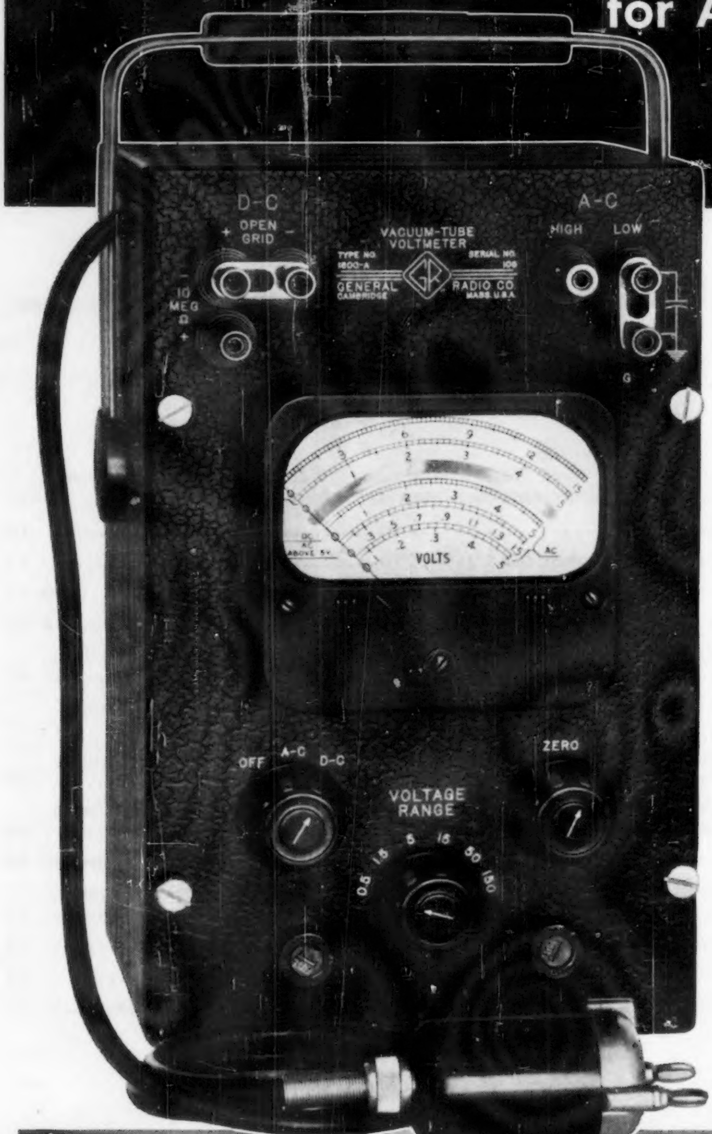
SEPTEMBER—1949

No. 160

for Audio and R-F Voltage Measurements of High Accuracy



The Type 1800-A Vacuum-Tube Voltmeter is a high-impedance, wide-range voltmeter which measures both d-c and a-c voltages up to several hundred megacycles with exceptional accuracy.

FEATURES

- **CALIBRATED FOR BOTH AC AND DC**
- **SIX OPEN-SCALE RANGES** covering 0.1 to 150 volts ac and 0.01 to 150 volts dc
- **ACCURACY** of ±2% for d-c and sinusoidal a-c voltages
- **WIDE FREQUENCY RANGE** as low as 20 cycles with error of less than 2%; with frequency correction, error less than 2% up to 300 Mc; useful for voltage indication up to 2,500 Mc
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- **SINGLE ZERO ADJUSTMENT** for all six ranges
- **EASY-TO-READ METER** with mirror for greater accuracy; no parallax; knife-edge pointer for upper scales and broad pointer for lower scales; face illuminated to eliminate glass reflections
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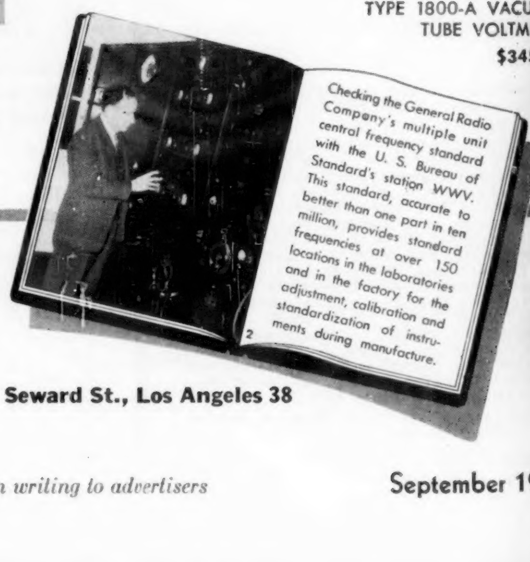
- **LOW INPUT CAPACITANCE** of about 3.1 micromicrofarads
- **STABILIZED PLATE VOLTAGE SUPPLY;** heater current regulated by ballast lamp
- **A-C OPERATED**

These three terminals for the probe are supplied: (1) G-R Type 274 plug terminals, (2) G-R Type 774 male and female coaxial terminals, (3) a 50-ohm terminating resistor for the probe, the latter is used to measure current and power in the termination of lines or other locations

For ac measurements this Type 1800-P2 Multiplier increases the range of the meter to 1500 volts. It consists of a capacitive voltage divider which provides a 10-to-1 reduction between voltages applied to the multiplier and those appearing across the meter terminals. TYPE 1800-P2 MULTIPLIER $18.00

TYPE 1800-A VACUUM-TUBE VOLTMETER
$345.00



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ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering, and Standardization of Specifications and Methods of Testing"

TELEPHONE—Rittenhouse 6-5315 | R. E. Hess, Editor | R. J. Painter, Associate Editor | CABLE ADDRESS—TESTING

Number 160 SEPTEMBER, 1949

Many Features at Pacific Area National Meeting

Technical Sessions, Committee Meetings, and Entertainment, of Widespread Interest at San Francisco Meeting, October 10–14

Plasticity and Creep of Metals
Soils
Fatigue of Metals
Bituminous Paving Mixtures
Dynamic Stress Determinations
Ceramic and Concrete Products
Application of Statistics
Modern Methods for the Determination of Metals in Petroleum Products
Cement and Concrete
High Additive Content Oils
Symposium on Use of Pozzolans
Turbine Oils
The World's Greatest Oil Hobby
Paint—Aircraft Finishes
Wood (Various Aspects)
Effect of Fuel on Diesel Engine Deposits
New Methods of Testing Paint
Cast Iron
Sandwich Materials
Lime, Mortar and Masonry

All Abo—o—o—o—ard for San Francisco!—or perhaps many of our members will be hearing a nice-looking stewardess on a plane say "Please fasten your seat belt"—and it is suspected many of the members driving to the coast will be hearing such questions as "John, did you put in the brown suitcase?" The preceding comments refer, of course, to attendance at the Society's First Pacific Area National Meeting at the Hotel Fairmont extending from October 10 to 14, inclusive. Many of the members have already made hotel reservations for themselves and families, and those planning to attend the meeting who have not done so are urged to act promptly.

This will be an outstanding meeting in many respects. In addition to the 70 technical papers to be presented in 15 formal sessions there will be many other speakers on special programs arranged by the Society's technical committees, several of which are meeting throughout the week. An excellent entertainment program for the ladies and for the men has also been prepared. Many details were given in the 16-page folder sent to all members and committee members in June.

This article has for its purpose giving some of the latest information about the meeting.

Fairmont Hotel atop Nob Hill

General Picture:

The accompanying table gives a summary of the events except that the ladies' program and entertainment are not detailed. These are covered later. This outline should *not* be interpreted as a schedule of committee meetings because many of the groups listed are having meetings of sections and subcommittees. All committee members will receive detailed schedules from their respective committee officers.

Particular attention is directed to the special meetings and features being arranged independently of the formal program by several of the committees. All committees are extending invitations to all interested to attend their meetings and several, as noted, are providing what should be outstanding programs.

To repeat, visitors and guests at the meeting are cordially invited to attend any of the committee meetings as well as the formal sessions.

Special New Features:

Several important new meeting developments have taken place since the last general communication to members on the meeting. First, there is to be a so-called "Kick-Off" general luncheon as the opening session on October 10. This is scheduled for 12 o'clock, and the

A.S.T.M. PACIFIC AREA NATIONAL MEETING

San Francisco, Calif. October 9–14, 1949

Sessions and Committee Meetings at Fairmont and Mark Hopkins Hotels

	Morning	2-Hour Luncheon Period	Afternoon	3-Hour Dinner Period	Evening
Sunday October 9			Registration—**Opens and Continues through Thursday**		
Monday October 10	Registration—**Continues through Thursday** Committee Meetings—C-1, D-2, D-18	"Kick-off" Luncheon and Opening Addresses	Opening Session Session—**Plasticity and Creep of Metals** Session—**Soils** Committee Meetings—C-1, D-2, D-8		Session—**Fatigue of Metals** Session—**Bituminous Paving Mixtures**
Tuesday October 11	Session—**Dynamic Stress Determinations** Session—**Ceramic and Concrete Products** Committee Meetings—C-1, D-2, D-18	Cement Industry Luncheon	Session—**Application of Statistics** Committee Meetings—C-9, D-2 (see Note A), D-4, D-18	**Cocktail Party—Reception—Buffet Supper Entertainment**	
Wednesday October 12	Session—**Cement and Concrete** Session—**Petroleum: Symposium on High Additive Content Oils** Committee Meetings—D-4, D-7 (see Note B)	Petroleum Industry Luncheon	Session—**Cement and Concrete: Symposium on Pozzolans** Session—**Petroleum: Symposium on Turbine Oils** Committee Meetings—D-4, D-7	Open Petroleum Lecture (see Note F)	
Thursday October 13	Session—**Paint: Aircraft Finishes** Session—**Wood** Committee Meetings—C-9, Jt. C-7-12-15 (see Note C), D-2 (see Note D)	Paint Industry Luncheon	Session—**Paint: New Methods of Testing** Session—**Symposium on Cast Iron** Committee Meetings—C-9, C-19 (see Note E), D-2 (see Note D)	**Boat Ride—Box Supper Dancing**	
Friday October 14	**All Day Trip to University of California Visit to Cyclotron and Engineering Laboratories Luncheon on the Campus**			Open	

Room assignments and complete schedule of committee meetings available in final program at registration desk at Hotel Fairmont.

Note A: This meeting will be featured by a Symposium on Modern Chemical and Instrumental Methods for the Determination of Metals in Petroleum Products.

Note B: Several technical discussions will be presented at the meeting of Committee D-7, morning and afternoon, see details below.

Note C: This joint committee meeting will include technical discussions on pertinent topics related to lime, mortar and masonry.

Note D: This meeting will feature a Symposium on Effect of Fuel on Diesel Engine Deposits.

Note E: The technical program at this meeting will include at least three papers on structural sandwich materials, covering mechanical tests of Radome material, durability tests of metalite, and testing constructions.

Note F: This lecture on "The World's Greatest Oil Hobby" by F. W. McCurry is to be presented at the Pacific Gas and Electric Co. Auditorium in downtown San Francisco.

addresses of welcome by the Chairman of the General Committee on Arrangements, Dozier Finley, and the Mayor or his representative, and the President's response will take place then. No advance reservations are necessary, but all those at the meeting, including the ladies, are urged to attend this luncheon. The two opening technical sessions then follow in the early afternoon.

Perhaps the most interesting new information covers the special meetings of various committees. Groups of technical papers or discussions have been arranged by Committee D-2 on Petroleum Products and Lubricants, Committee D-7 on Wood, C-19 on Structural Sandwich Constructions, and a joint group representing C-7 on Lime, C-12 on Mortars, and C-15 on Masonry Units—all of which supplement the formal technical program. The chief purpose is to stress work which the committees have under way or provide latest information on the topics by having members and other authorities describe some of the interesting work and provide a peek into the future in some cases. Details of some of these meetings are given below.

Petroleum Lecture.—A special feature, not a part of the official program but to which all are invited, has been arranged by Committee D-2 constituting a lecture, "The World's Greatest Oil Hobby" (see below for some details).

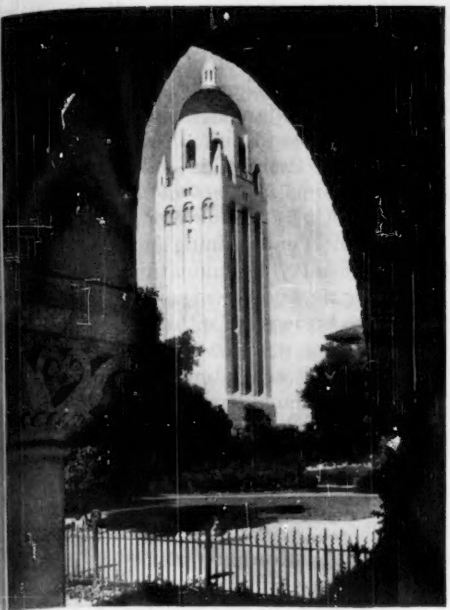
Cement, Petroleum, and Paint Industry Luncheons

Among the interesting features of the meeting are three industry luncheons. a Cement Luncheon for Tuesday, October 11; a Petroleum Luncheon for Wednesday, October 12; and a Paint Luncheon for Thursday, October 13. The primary purpose of these luncheons is to afford an opportunity for members and visitors working in these fields to get together for acquaintanceship and sociability. They also afford an opportunity of inviting executives from these industries from the Pacific Coast Area to meet with those in the Society who are working on tests and specifications in these fields, and to gather from the talks at these luncheons the value and significance of A.S.T.M. work to their industry. The technical committees meeting in San Francisco and sponsoring various technical programs are welcoming the opportunity that these luncheons afford of meeting with members and visitors from the Pacific Coast.

It is quite likely that there may be other informal luncheon or dinner meetings of some of our committees, of which due announcement will be made in the Official Program.

Technical Sessions

Because the 16-page Announcement on the Pacific Area meeting was sent to all members and committee members, it is not planned to cover the technical program in detail here; nevertheless it should be stated that the 15 sessions provide a wealth of interesting



Hoover Library at Stanford

material and there is a great diversity of subjects covered.

Those concerned with metals will find the discussion on plasticity and creep and on fatigue of much interest, and also the Symposium on Cast Iron. This latter now is to include four technical papers which will give a condensed description of the cast irons which are available today. Committee A-3 on Cast Iron, which developed the symposium through the intensive efforts of Hyman Bornstein, has planned that not only will there be good coverage of various tests used to develop the material and the significance of specifications but that some of the newer phases will be dealt with including nodular cast iron. This material will be referred to in several of the papers and the discussion will bring out pertinent data on this interesting material.

Many of the other technical sessions will produce new information that will be of value to the users and producers alike.

There are numerous papers dealing with ceramic and concrete products, cement, and soils, as well as bituminous paving mixtures and wood and wood products.

Two symposiums in the field of petroleum covering high additive content oils and turbine oils will be just part of the week-long program of interest to this field.

In two full sessions, leading authorities will cover significant aspects of paint, including discussion of aircraft finishes and new methods for testing paints and paint materials.

Of wide interest is the session on Application of Statistics which cuts right across all material fields, and likewise of broad concern are the four papers dealing with Dynamic Stress Determinations.

Entertainment and the Social End in San Francisco

The Committee on Entertainment for the Pacific National Meeting, headed by H. A. Sawin, has a most interesting program of entertainment and social activities arranged. The program was outlined in considerable detail in the general announcement which each member and committee member received (extra copies are available for the ladies if desired), and at least three of the high spots of the entertainment program are affairs in which the men will participate. The latter include the Cocktail Party, President's Reception and Buffet Supper on Tuesday night, October 11; the Boat Ride, Supper and Dancing on Thursday evening, October 13; and the all-day Inspection Trip and Luncheon at the University of California on Friday.

A chronology of the entertainment follows—full details will be given in the final program for the meeting. *In the meanwhile all members whose wives and other members of their families will be with them and participate in the Ladies' Entertainment Program are urged to advise Mr. Sawin of the events in which it is expected the ladies will be participating.* This advance information will be helpful to him and his committee in planning the various affairs. He should be addressed as follows: H. A. Sawin, Chairman of Entertainment Committee, Yuba Manufacturing Co., 351 California St., San Francisco 4, Calif.

Entertainment Program and Social Events

Sunday, Oct. 9	Registration, Fairmont Hotel; Ladies' Desk open beginning Sunday, full details available
Monday, Oct. 10	Scenic Tour (3½ hours)
Tuesday, Oct. 11	Luncheon at St. Francis Yacht Club; *Evening*—Cocktail Party, Reception, Buffet Supper
Wednesday, Oct. 12	Luncheon and Fashion Show
Thursday, Oct. 13	Tour of Stanford University; *Evening*, Boat Ride on San Francisco Bay, Box Supper, Dancing
Friday, Oct. 14	Inspection Trip and Luncheon, University of California

Each of the above affairs will be interesting and worthwhile. The cost of the various events will be announced later.

Determining Metals in Petroleum Products

This Symposium on Modern Chemical and Instrumental Methods for the Determination of Metals in Petroleum Products (Tuesday afternoon, October 11) is sponsored by Committee D-2 on Petroleum Products and Lubricants, which also is arranging another symposium on Thursday morning and afternoon dealing with Diesel Fuels. The committee is cooperating also in the two formal A.S.T.M. technical sessions listed in the main program, involving high additive content oils (Wednesday morning) and turbine oils (Wednesday

Technical Papers Not Preprinted—Limited Copies Available

Although none of the technical papers to be presented at the 15 formal sessions of the Pacific Area National Meeting will be preprinted, many of the authors are cooperating to the extent of supplying a quantity of duplicated copies of their papers or abstracts thereof, and these will be available for distribution on request *to those at the meeting.*

It is hoped that a sufficient supply of the papers can be earmarked to take care of requests which other members may make for the papers, and it is presumed that those interested in a specific contribution will write to A.S.T.M. Headquarters and request the item. Such communications should make clear the papers desired.

Following the meeting these requests will be filled in so far as possible, although it is not known at this time just which papers can be furnished.

Publication of many of the papers either as groups in special technical publications or individually in the Bulletin or elsewhere is planned, and members will be advised from time to time just which of the items are being printed. Considering the very heavy publication schedule including the 1949 Book of Standards and *Proceedings*, no estimate can be given when any of the papers or special technical publications will be issued.

afternoon). The Symposium on Determination of Metals will reflect through its six papers as noted here the considerable amount of work being done, and the progress that has been made in the analytical laboratories of the industry in applying the principles of physics and apparatus techniques to problems in determining metals in petroleum. Dr. Louis Lykken, Shell Development Co., Emeryville, Calif., has acted as chairman of the committee responsible for this significant discussion and has sparkplugged its development. The program follows.

Symposium on Modern Chemical and Instrumental Methods for the Determination of Metals in Petroleum Products

Introductory Remarks—L. Lykken

Polarographic Determination of Copper, Nickel, and Vanadium in Petroleum Products—D. R. Hild, Paul C. Ross, and Ralph O. Clark, Gulf Research and Development Co.

Procedures are described for the polarographic determination of copper, nickel, and vanadium, and experimental data are presented to demonstrate the reliability and simplicity of the method.

Photometric Determination of Iron, Copper, Nickel, and Vanadium in Petroleum Products—Robert E. Snyder and Ralph O. Clark, Gulf Research and Development Co.

Methods are presented for the photometric determination of iron, copper, nickel, and vanadium, and for the removal of interfering cations. Factors that affect the accuracy of the various analyses are considered and a short discussion of the relative merits of colorimetry and polarography for ash analysis is included.

Flame Photometric Determination of Calcium in Lubricating Oils—L. C. Jones, Shell Oil Research Laboratories

The use of modified Perkin Elmer Model 18 flame photometer for the determination of calcium is described. Interferences and methods of sample preparation designed to reduce the effect of these interferences are also discussed.

Amperometric Determination of Iron and Copper in Lubricating Oils—T. D. Parks and L. Lykken, Shell Development Co.

Procedures are given for the determination of small amounts of copper and iron in lubricating oils by reduction to the cuprous and ferrous states with a Walden reductor and subsequent amperometric titration with dichromate solution.

The Spectrographic Determination of Phosphorus and Metal Additives in Oil Using a Solutions Excitation Attachment—J. P. Pagliassotti and F. W. Porsche, Standard Oil Co. (Indiana)

A spectrographic method for the analysis of lubricating oils for phosphorus and metal additives is described. The method makes use of a disk of graphite as a lower electrode which rotates through the oil and causes the sample to be carried into the analytical gap where it is consumed. The accuracy of the method and the effect of viscosity are also discussed.

Determination of Inorganic Elements in Oils by X-ray Absorption—Ralph C. Vollmar, Standard Oil Co. of California

A general discussion is given of the use of X-rays in the photometric and spectrophotometric determination of inorganic elements (such as lead, tetraethyl lead, and sulfur) in petroleum products.

Effect of Fuel Upon Diesel Engine Deposits

The second of two symposiums arranged by Committee D-2 for presentation at its meetings, this one concerns the effect of fuel upon Diesel engine deposits. It is scheduled for Thursday morning and afternoon, October 13. W. G. Ainsley, Secretary of Technical Committee F on Diesel Fuels of Committee D-2 has arranged the program which is tentatively outlined as follows:

Distillate Fuel Manufacture—Speaker to be announced.

Effect of Fuel Upon Diesel Engine Deposits—*Speakers:* Harry F. Bryan, Research Engineer, International Harvester Co.; L. A. Blanc, Associate Director of Research, Caterpillar Tractor Co.; C. C. Moore, Research Supervisor, Union Oil Co.; A. G. Cattaneo, Head of Motor Laboratory, Shell Development Co.

Following luncheon, the discussion will be continued with a summary of the papers presented in the morning session, followed by round-table discussion.

The World's Greatest Oil Hobby

One of the notable special features of the meeting recently announced is the lecture on Wednesday night, October 12, on "The World's Greatest Oil Hobby" to be given by Frank W. McCurry, Vice-President in Charge of Manufacturing, Derby Oil Co., Wichita, Kans. This lecture will be at the Pacific Gas and Electric Co. Auditorium, *and not at the Fairmont.* Mr. McCurry has developed his hobby into a most entertaining and educational affair, displaying a miniature oil refinery, drilling rig, and flowing oil well, and covers the business of oil recovery and refining in a way that has brought him widespread recognition. Following the elaborate demonstration which he puts on with his lecture there are other special exhibits. Some idea of the extent of the display may be gained from the fact that it is necessary to have a space 25 ft. in width for the equipment. Everyone is cordially invited to attend this lecture which takes place on an otherwise open night of the A.S.T.M. meeting.

Various Aspects of Wood

A.S.T.M. Committee D-7 on Wood, one of the oldest A.S.T.M. committees, has arranged a general session for its committee meeting beginning Wednesday, October 12, with six addresses and papers on pertinent topics, all of which should be of interest to anyone concerned with wood and its utilization. All interested are cordially invited to attend. This committee meeting thus amplifies the general program in this field which includes five technical papers on wood in a formal A.S.T.M. session on Thursday morning, October 13.

A.S.T.M. Vice-President L. J. Markwardt, who is Chairman of Committee D-7, has developed the following program:

Santa Monica Beach Where Citizens of Los Angeles Bask in the Warm Pacific

Advice on Transportation

The Transportation Committee, headed by P. V. Garin, Southern Pacific Co., 65 Market Street, San Francisco 5, Calif., is anxious to have, as soon as possible, advice from any members who are interested in special trains or special railroad cars. Members are therefore urged to write Mr. Garin promptly if they are so interested. He will advise whether it is possible to make arrangements for special railroad transportation; this depends almost entirely on the number of members involved.

1. The Field of Work of the A.S.T.M. and of Committee D-7 on Wood—L. J. Markwardt
2. International Standardization of Methods of Testing Wood—W. E. Wakefield
3. The Program of Pole Tests Under the Sponsorship of Subcommittee VII on Wood Poles and Cross Arms—C. D. Hocker, *Chairman*, L. J. Markwardt
4. Plywood and Veneer—Methods of Tests, Definitions, and Species Classifications—J. A. Liska
5. Progress in the Development of Accelerated Tests for Evaluating the Integrity of Glue Joints
6. Wood Preservation and Review of Recent A.S.T.M. Specifications for Wood Preservatives Adopted by the A.S.T.M.

Following the presentation of each paper the meeting will be open for discussion of the topics. It is expected this meeting will extend into Wednesday afternoon.

Invitation to Visit Bureau of Reclamation in Denver

A cordial invitation is extended by R. F. Blanks, Chief, Research and Geology Division, Bureau of Reclamation, Denver, for all A.S.T.M. members and committee members who may be in Denver on their way to or from San Francisco to visit the Engineering Laboratories of the Bureau. A tremendous amount of research and investigative work is carried out in the Laboratories and much of this and the excellent facilities that are available would no doubt interest many of our people, particularly those concerned with structural materials.

Mr. Blanks, who is a member of the General Committee on Arrangements for the Pacific Meeting, and who is active in other phases of A.S.T.M. work, would appreciate it if members planning to visit the laboratories would advise him so that arrangements can be made.

Industrial and Plant Visits

Information just received from the Committee on Plant Visits, headed by S. A. Abrahams, The Paraffine Cos., Inc., indicates a most interesting program that will be available for the members. Tentatively all visits are being arranged for Thursday and Friday which will give the members attending the meeting plenty of opportunity for selection. The tentative program is given below, but this is subject to change, and members should consult the official program at the meeting for final details.

The committee plans to have the members indicate at the time of registration which laboratories or plants they would wish to visit. This is important because certain of the trips, for example to Stanford and to some of the cement companies, will involve buses, and it is necessary to have fairly accurate information on the number to go. There will be a nominal charge in connection with certain of the visits to cover transportation.

Other plants than those shown in the accompanying list where visits can be made will be listed at the committee's headquarters in the Fairmont Hotel.

Pacific Northwest, Denver and Southern California.—To aid members who may wish to visit plants in the Pacific Northwest or, Southern California or Denver, certain members of the Plant Visits Committee in those areas have been designated as contacts, and members who plan stop-overs can write to the following members who will aid in so far as possible in making arrangements.

For the Southern California Area:

Harry V. Welch
Western Precipitation Co.
1016 W. 9th St.
Los Angeles 15, Calif.

R. E. Paine
Aluminum Co. of America
5151 Alcoa Ave.
Los Angeles, 11 Calif.

For the Pacific Northwest:

R. H. Rawson
Consulting Timber Engineer
Yeon Building
Portland, Ore.

For the Denver Area: (see also accompanying box).

R. F. Blanks
U. S. Bureau of Reclamation
Denver Federal Center
Denver, Colo.

Prof. O. C. Shepard is serving as Vice-Chairman of the Plant Visits Committee, and is assisting Mr. Abrahams, the Committee Chairman. The latter may be addressed at The Paraffine Cos., Inc., Emeryville 8, Calif.

General Committee on Arrangements

Pacific Area National Meeting

Dozier Finley, *Chairman*, Research Consultant, Berkeley

C. E. Emmons, *Vice-Chairman*, The Texas Company, Los Angeles

C. F. Ramey, *Secretary-Treasurer*, Standard Oil Co. of California, 225 Bush St., San Francisco 20

R. F. Blanks, U. S. Bureau of Reclamation, Denver
T. P. Dresser, Jr., Abbot A. Hanks, Inc., San Francisco
W. C. Hanna, California Portland Cement Co., Colton
T. K. May, West Coast Lumberman's Assn., Portland
W. W. Moore, Dames & Moore, San Francisco

Committee Chairman

Technical Program—R. E. Davis, University of California, Berkeley.
Hotel—S. L. Davidson, National Lead Co., San Francisco.
Registration—F. M. Harris, Pacific Gas and Electric Co., San Francisco.
Transportation—P. V. Garin, Southern Pacific Co., San Francisco.
Entertainment—H. A. Sawin, Yuba Manufacturing Co., San Francisco.
Plant Visits—S. A. Abrahams, The Paraffine Cos., Inc., Emeryville.
Dinner—G. E. Solnar, Jr., Clay Brick Mfrs. Assn. of Northern California, San Francisco.
Publicity—T. K. Cleveland, Philadelphia Quartz Co. of California, Berkeley.
Finance—G. L. von Planck, Columbia Steel Co., San Francisco.
Liaison and Detailed Arrangements—T. S. Hersey, Hersey Inspection Bureau, Oakland.

Tentative Schedule of Plant Visits

	Committeeman in Charge
Thursday, October 13th—Morning	
1. Pacific Portland Cement Co., Redwood City........	A. G. Lang
2. Permanente Cement Co., Los Altos...	J. M. Garouttee and A. G. Lang
3. U. S. Naval Lab. (wind Tunnel), Moffett Field.....	E. A. Crellin
4. Tidewater Associated Oil Co., Associated..........	L. Mittelman and R. C. Vollmer
5. Shell Development Co., Lab., Emeryville............	R. C. Vollmer
If enough interested members, visits possible to:	
Westinghouse Plant at Sunnyvale	
Fibreglas plant at Santa Clara	

Paraffine Companies Asbestos Cement Products Plant, Redwood City

Thursday, October 13th—Afternoon

1. Stanford Industrial Research Laboratory, Palo Alto... R. M. Van Valkenburg
2. Stanford Engineering Laboratory, Palo Alto............. O. C. Shepard
3. Dow Chemical Co., Pittsburg......... Clyde Davis
4. Columbia Steel Co., Pittsburg......... O. L. Davis

In addition, Port Costa Brick Works and other clay products plants will be available for inspection.

Arrangements can be made to visit these plants at convenient times by any member of the Society:

1. Standard Oil Refinery, Richmond.... R. E. Vollmer
2. W. P. Fuller & Co., South San Francisco............. L. A. O'Leary
3. Pacific Gas & Electric Co. Steam Plants........... F. M. Harris
4. U. S. Naval Ship-Building Plant, Hunter's Point.... E. A. Crellin

Friday, October 14th—All day, including Luncheon

University of California Materials Engineering Laboratory and Radiation Laboratory (cyclotron), Berkeley... G. E. Troxell

Actions by Standards Committee Affect Plastics, Electronic Devices, Glass Containers, and Asbestos Cement Products

A NUMBER of actions have been taken by the Administration Committee on Standards on the recommendations of the various technical committees. As shown in the attached table some of these are revisions of existing tentatives and some are new tentatives issued for the first time.

Electronic Devices:

The new Tentative Specification for Circular Cross Section Nickel Cathode Sleeves for Electronic Devices (B 239) covers the sleeves either seamless, welded and drawn, or lock seam, for use as indirectly heated oxide coated cathodes in electronic devices. The intensive work leading up to this new standard was done in the Cathode Section of Committee B-4's Subcommittee VIII on Metallic Materials for Radio Tubes and Incandescent Lamps. This group has an extremely active program of research as well as development of test methods and specifications, as has been publicized in the ASTM BULLETIN and committee reports. The new specification gives an extensive table of compositions and the tests that are applied, specifically the stiffness test. Dimensional requirements are also included.

Glass Containers:

The active program of standardization being carried out in Committee C-14 on Glass and Glass Products has resulted in new methods of sampling glass containers, that is, bottles, jars and similar products, when mechanical strength, dimensions, and other characteristics are to be determined. The standard sets up four characteristics for sampling purposes, namely, grade of annealing, hydrostatic pressure and thermal shock strength, visible characteristics, and mold characteristics.

There have developed in the industry recognized procedures for evaluating the resistance of containers to various types of chemical attack, and the new methods listed accordingly cover these aspects. C 225 (Test B-A), for example, is used when the products in the containers would have a pH of less than 5.0; C 226 (Test B-W) is applicable when the containers would be used for products with a pH of 5.0 or more; and the third test, C 227 (P-W), is applicable to containers that are extremely small, such as ampoules.

In all cases an autoclave or steam sterilizer is used, and detailed requirements are given for the reagents, for preparing the sample and the procedure.

Asbestos Cement Products:

The new Specifications for Asbestos-Cement Flat Sheets (C 220) and Asbestos-Cement Corrugated Sheets (C 221) are the first to come from Committee C-17. In C 220 the composition and manufacture are described as follows: "Asbestos-cement flat sheets shall be composed of a uniform mixture of portland or portland-pozzolana cement, asbestos fiber, and not more than one per cent by weight of organic fiber, with or without the addition of a curing agent, water-repellent substance, coating, pigments, mineral granules or mineral fillers, formed under pressure and thoroughly cured." Requirements are given concerning flexural strength, water absorption, thickness, and there are details on dimensions.

The new Tentative Specification for Corrugated Sheets (C 221) covers material that is used for structural and related purposes and for decorative or other purposes.

Plastics:

Supplementing its definitions of terms, Committee D-20 on Plastics has agreed on terms which will be included in the expanded Definitions D883 covering "thermoplastic" and "thermoset." These definitions are as follows:

> *Thermoplastic* (adjective) means capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature. (Footnote: "Thermoplastic" applies to those materials whose change upon heating is substantially physical.)
>
> *Thermoplastic* (noun) is a plastic which is thermoplastic in behavior.
>
> *Thermoset* (noun) is a plastic which, when cured by application of heat or chemical means, changes into a substantially infusible and insoluble product.
>
> *Thermosetting* (adjective) means changing into a substantially infusible or insoluble product when cured under application of heat or chemical means.

The revised Method of Test for Tensile Properties of Thin Plastic Sheets and Film (D 882) incorporates improved testing techniques and should provide better test results.

Actions of A.S.T.M. Administrative Committee on Standards

New Tentatives

Specifications for:

Circular Cross-Section Nickel Cathode Sleeves for Electronic Devices (B 239 – 49 T) (June 24).

Asbestos-Cement Flat Sheets (C 220 – 49 T) (July 27).

Asbestos-Cement Corrugated Sheets (C 221 – 49 T) (July 27).

Methods of:

Sampling Glass Containers (C 224 – 49 T) (July 27).

Test for Resistance of Glass Containers to Chemical Attack (Test B-A) (C 225 – 49 T) (July 27).

Test for Resistance of Glass Containers to Chemical Attack (Test B-W) (C 226 – 49 T) (July 27).

Test for Resistance of Glass Containers to Chemical Attack (Test P-W) (C 227 – 49 T) (July 27).

Revision of Tentatives

Method of:

Test for Tensile Properties of Thin Plastic Sheets and Film (D 882 – 49 T) (May 13).

Definitions of:

Terms Relating to Plastics (D 883 – 49 T) (May 13).

Very Extensive Publication Schedule for 1949–1950

Includes New Book of Standards, Special Compilations, and Special Technical Publications; Some 12,000 Pages

1949 being the year for the appearance of the complete Book of Standards, and with a great many compilations of standards and special technical publications as well as a large *Proceedings*, the Staff and our printers are faced with a heavy schedule for 1949 and 1950. The expansion of the BULLETIN from 6 to 8 issues a year has also increased the amount of material the Society will publish during the next year.

One of the problems that lies ahead is that of publishing the technical papers and discussion that will be presented at the Pacific Area National Meeting to be held in October in San Francisco. None of the papers will be preprinted, but it is hoped to have mimeographed copies of many of them available at the meeting. While a final decision on method of publication has not been made, it is probable that most of the papers will be published in appropriate groupings in the Society's Special Technical Publication series. Others may appear in the ASTM BULLETIN either in full or as extended abstracts. More specific announcement of publication plans will be made later.

Regular Publications

1949 Book of Standards:

The most important and certainly the biggest publication problem now in hand is the 1949 edition of the Book of A.S.T.M. Standards, which, as already announced, will be published in six parts. The approximate classification of contents of these parts has been announced to the members, together with the revised scale of charges to members for procuring more than one part of the Book on their membership. This year for the first time the six volumes will be published as a grouping together of separate compilations by making up and printing the individual compilations and overrunning on press the desired number of impressions for the Book of Standards. This will require special methods of paging and indexing.

It is estimated that the 1949 Book of Standards will total close to 9000 pages.

1949 Proceedings:

The 1949 *Proceedings* (to be issued about December) are expected to exceed in volume those of the preceding year, for while the program on papers developed by the Administrative Committee on Papers and Publications will entail about the same number of *Proceeding* pages as for 1948, the volume of committee reports is larger, as is to be expected from the steady expansion of committee work into new fields. The papers presented at the Annual Meeting as a part of special symposiums will appear separately as special technical publications.

1949 Index to A.S.T.M. Standards:

This Index continues to increase in value as the number of standards becomes larger, and again it will give the latest complete reference to publications where the various specifications and test methods appear. The Index should be particularly helpful this year in view of the appearance of the 1949 Book of Standards in 6 separate volumes. Publication of the new edition is scheduled for February, 1950, and will probably aggregate 260 pages.

1949 Year Book:

The Year Book, containing a list of the complete membership and official company-member representatives (name, title, address, company, etc.), and a list of geographical distribution of members as well as personnel of all A.S.T.M. committees, is furnished to members on request, The 1949 book should aggregate 575 pages and is scheduled for distribution early in October.

Special Compilations of Standards

The tabulation given below of special compilations of standards should be viewed only as *approximate*. There are so many factors affecting these books that it is not possible to give any accurate estimate of size or the date that they may become available. The size is affected by committee recommendations which may be coming through the Administrative Committee on Standards and the date of issue is governed somewhat by editorial considerations and the appearance of the Book of Standards, but also to a great extent by the tremendous load our printers are carrying.

Soils for Engineering Purposes.—This book on which extensive work has been under way, will include not only all the A.S.T.M. standards pertaining to soils, but many proposed methods which are published as information and to elicit comments. A major portion of the book is devoted to these procedures, which were submitted through the effort of Committee D-18. This book thus will give a rather complete picture of methods of determining and evaluating various properties of soils, those that have been standardized as well as many that are under study. Available about Oct.-Nov.

Special Technical Publications, Symposiums, etc.

The following symposiums featured as part of the 1949 Annual Meeting will be published separately with discussion.

1949 Annual Meeting Symposiums:

Accelerated Durability Testing of Bituminous Materials.—13 technical papers; 130 pages.
Evaluation Tests for Stainless Steels.—10 technical papers; 120 pages.
Testing Cast Iron with SR-4 Type of Gage.—15 technical papers; 64 pages.
Rapid Methods for the Identification of Metals.—10 technical papers; 120 pages.
Radiography.—7 technical papers; 64 pages.
Ultrasonic Testing.—7 technical papers; 64 pages.

Manual on Fatigue Testing:

The purpose of this manual prepared by Committee E-9 on Fatigue is to supply information to those setting up new laboratory facilities, to aid in operating the equipment properly, and to offer advice in presentation and interpretation of the data. A further objective is the setting up of recommended practices which may later on be crystallized into standards. The manual concerns itself with fatigue testing and not with fatigue of metals as such except for making some reference to the need for securing service data to correlate with laboratory tests. Test data and theories of failures are, therefore, outside the scope of the manual, although a discussion of the limitations of fatigue tests is considered appropriate and important. The eight sections include:

Introduction.......	R. E. Peterson
Symbols and Nomenclature for Fatigue Testing.....	J. M. Lessells

Fatigue Testing Machines	O. J. Horger
Specimens and Preparation	J. B. Johnson
Test Procedure and Technique	W. N. Findley
Presentation of Fatigue Data	L. R. Jackson
Interpretation of Fatigue Data	R. L. Templin
Bibliography	T. J. Dolan

The book will aggregate around 150 pages. Available in Nov.-Dec.

Symposium on Insulating Oils:

This is the third of a series of papers sponsored by Committee D-9 on Electrical Insulating Materials. The first symposium was held in Atlantic City in October, 1946, and was published in the May, 1947, ASTM BULLETIN. The second symposium was presented in June, 1947, in conjunction with the Annual Meeting of the Society held in Atlantic City and was published in the December, 1947, issue of the BULLETIN. The third symposium was held in March of this year in Washington, but contrary to previous practice will be published as a separate technical publication. The three papers comprising this publication are as follows:

- One System of Laboratory Testing to Appraise Serviceability of Oils in Transformers, by R. G. Call
- Performance Characteristics of the Askarels, by F. M. Clark
- Performance of Inhibited Transformer Oils, by G. H. von Fuchs

It is also planned to include the discussion of these papers in this publication. The total number of pages will be around 32. Available about Nov.-Dec.

Symposium on Lubrication of Turbine Gear Equipment:

This symposium was sponsored by Technical Committee C on Turbine Oils of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants. It was felt that there was a need to have a full discussion of the lubrication of turbine-driven gears in order that those interested would better understand some of the problems. The authors who have contributed papers to this symposium have given a clear picture of the operating problems, the design problems, and what has been accomplished in perfecting the gears and lubricating systems in bringing about the tremendous improvements in geared sets and the possible improvements yet to be realized. The titles of the papers are as follows:

- Introduction—F. C. Linn
- Lubrication of Naval Gearing—R. T. Simpson
- Developments in Gear Design and Their Lubrication Requirements—L. J. Collins
- Physical Concepts of the Establishment of the Lubrication Oil Wedge and Its Associated Load-Carrying Capacity for the Mating Tooth Surfaces of High-Speed Gears—Ernest K. Gatcombe
- Fundamentals of Worm Gear Lubrication—A. R. Purdy

Ready about October.

COMPILATIONS OF STANDARDS

Committee Sponsoring	Title	Approximate Number of Pages	Approximate Publication Date
A-1	Steel Piping Materials	230	Dec.-Jan.
B-5	Copper and Copper Alloys, Cast and Wrought	530	Oct.-Nov.
B-8	Electrodeposited Metallic Coatings	58	Oct.-Nov.
C-1	Cement	205	Nov.-Dec.
C-9, D-4	Mineral Aggregates, Concrete, and Nonbituminous Highway Materials	220	Nov.-Dec.
C-14	Glass and Glass Products	110	Nov.-Dec.
D-1	Paint, Varnish, Lacquer and Related Products	600	Oct.-Nov.
D-2	Petroleum Products and Lubricants	780	Nov.-Dec.
D-5	Coal and Coke	175	Sept.-Oct.
D-6	Paper and Paper Products		
D-9	Electrical Insulating Materials	650	Dec.-Jan.
D-11	Rubber and Rubber-Like Materials	600	Dec.-Jan.
D-12	Soaps and Other Detergents	140	Nov.-Dec.
D-13	Textile Materials	575	Oct.-Nov.
D-14	Adhesives	66	Oct.-Nov.
D-18	Soils for Engineering Purposes	300	Oct.-Nov.
D-20	Plastics	640	Jan.-Feb.

Symposium on Metallography in Color:

This symposium was held at the 1948 Annual Meeting of the Society, being sponsored by Committee E-4 on Metallography. The papers comprising this publication were prepared because of the growing interest in the field and the need for latest information on the proper techniques to use to record in pictures the characteristic colors which metallographers see visually. Excellent color reproductions of microstructures can be had if a certain few basic conditions are adhered to. It is believed this is the first time that a group of papers dealing with the techniques of making colored transparencies or photographs and their application to metallography has been brought together in one place. It is hoped that through the application of the techniques described, color photographs will find broad and profitable uses. Scheduled for June, 1949, publication was delayed; probable appearance date about Oct.-Nov.

Symposium on Effect of Low Temperature on Materials:

The Symposium on Effect of Low Temperature on Materials was presented at a meeting sponsored by the Philadelphia District Committee in March, 1946, and all but one of the papers are in type. It is hoped the final work on this manuscript will be completed soon.

Symposium on Speed of Testing:

It is planned to reprint this symposium which was presented at the 1948 Annual Meeting and which was published in the 1948 *Proceedings*. Some additional material is being added, however, and it is hoped that the book will be available shortly.

1949 Marburg Lecture—Stresses in Metals:

The excellent and informative lecture on "Residual Stresses in Metals" given by Dr. William M. Baldwin at the 1949 Annual Meeting will be available early this fall. It will also appear

LIST OF PENDING PUBLICATIONS
(Discussed in Detail in Accompanying Article)

Regular Publications

1949 Book of A.S.T.M. Standards
1949 Proceedings
1949 Index to A.S.T.M. Standards
1949 Year Book

Special Compilations

Steel Piping Materials
Wire for Electrical Conductors
Copper and Copper Alloys, Cast and Wrought
Light Metals and Alloys, Cast and Wrought
Electrodeposited Metallic Coatings
Cement
Mineral Aggregates, Concrete, and Nonbituminous Highway Materials
Glass and Glass Products
Paint, Varnish, Lacquer and Related Products
Petroleum Products and Lubricants
Coal and Coke
Paper and Paper Products
Electrical Insulating Materials
Rubber and Rubber-Like Materials
Soaps and Other Detergents
Textile Materials
Adhesives
Soils for Engineering Purposes
Industrial Water
Plastics

Technical Publications and Papers

Manual on Fatigue Testing
Metal Cleaning Bibliographical Abstracts
X-Ray Diffraction Data Cards
1949 Appendix to A.S.T.M. Manual of Engine Test Methods for Rating Fuels
Tables of Chemical Compositions and Properties of Iron-Chromium and Iron-Chromium-Nickel Alloys
Marburg Lecture

Symposiums

Accelerated Durability Testing of Bituminous Materials
Evaluation Tests for Stainless Steels
Testing Cast Iron with SR-4 Type of Gage
Rapid Methods for the Identification of Metals
Radiography
Ultrasonic Testing
Insulating Oils
Lubrication of Turbine Gear Equipment
Metallography in Color
Effect of Low Temperature on Materials
Speed of Testing

in the 1949 *Proceedings*. The lecture covers the fundamental differences in the mechanisms by which residual stresses are developed by cold-working operations such as rolling, drawing, extrusion, etc.; by heat treatment; and by casting and welding. Also discussed are the experimental methods used to evaluate residual stresses; various residual stress patterns found in fabrication; effects of residual stresses; and methods for the elimination of residual stresses.

Metal Cleaning Bibliographical Abstracts:

Due to the increased interest in the subject of metal cleaning, it was felt desirable to consolidate all previous material in one place as well as add a large group of additional references. Several helpful indexes have also been included. This book is discussed in greater detail on this page of the BULLETIN. Ready soon.

1949 Appendix to A.S.T.M. Manual of Engine Test Methods for Rating Fuels:

This appendix has been prepared by the Division on Combustion Characteristics, of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants. It includes recent changes in the 1948 Manual of Engine Test Methods for Rating Fuels. The material published in the 1948 Appendix to the Manual will also be included in the 1949 edition. An up-to-date table on list of equipment changes with the latest part numbers will be included, along with information on a proposed carburetor jacket for use with motor and research methods to rate high-vapor-pressure fuels. This appendix will be approximately 32 pages in length. Ready about December.

X-Ray Diffraction Data Cards:

The Society is bringing out a revised edition of the original set of cards and the first supplementary set of cards, and in addition a new second supplementary set of cards comprising some 1350 compounds. All three sets are being made available on an entirely new format designed to be more valuable to the users as discussed in a separate article in this BULLETIN (see page 18).

Tables of Chemical Compositions and Properties of Iron-Chromium and Iron-Chromium-Nickel Alloys:

In 1942 the Society collected and published information on wrought alloys in the above classifications. These data have been reviewed and revised and corresponding data have been assembled on cast alloys. All of this complete, up-to-date information will be published in a combined compilation later this year.

Bibliographical Abstracts Issued

(a) Metal Cleaning; (b) Electrical Contacts

EARLY in July the 1948 Supplement to the 1944 Bibliography and Abstracts on Electrical Contacts was published, and shortly to be issued is an important new publication covering Metal Cleaning Bibliographical Abstracts over the period 1893–1949.

Electrical Contacts

The 1948 Supplement to the Bibliography on Electrical Contacts, which publication includes extensive abstracts, is the fifth Supplement to the original Bibliography issued in January, 1944. The rather arduous task of compiling the Bibliography and the Supplements was carried out by certain members of Subcommittee X on Electrical Contacts of A.S.T.M. Committee B-4 on Electrical Heating Resistance and Related Alloys (E. I. Shobert, II, of the Stackpole Carbon Co., serving as *Chairman*, assisted by Messrs. George Durst, General Plate Division of Metals and Controls, Inc., V. E. Heil, P. R. Mallory & Co., and C. K. Strobel, Robertshaw Thermostat Corp.).

This publication, including its Supplements, is really a monumental one and is of outstanding service to all those concerned with this field. The 1948 Supplement includes a number of replacements and new references for the period 1940 through 1946 and several pages of new material.

The price to members for the 24-page 1948 Supplement is 60 cents, the list price to nonmembers being 75 cents. The prices for the earlier publications are as follows:

Original Bibliography, January, 1944: 148 pages, 6 by 9 in., cloth cover, $5; to A.S.T.M. members, $4. [1835–1942.]

First and Second Supplements, combined, April, 1945 and 1946—48 pages, 6 by 9 in., paper cover, $1.50; to A.S.T.M. members, $1.15. [(1942–1945 plus earlier references) STP 56-A and STP 56-B.]

Third Supplement (1946), June, 1947: 26 pages, 6 by 9 in., paper cover, 75 cents; to A.S.T.M. members, 60 cents. [(Through late 1946 with numerous earlier references, particularly 1944–1945) STP 56-C.]

Fourth Supplement (1947), July, 1948: 28 pages, 6 by 9 in., paper cover, 75 cents; to A.S.T.M. members, 60 cents. [(Through 1946 and 1947, with replacements and new references for 1940–1945) STP 56-D.]

Fifth Supplement (1948), June, 1949: 24 pages, 6 by 9 in., paper cover, 75 cents; to A.S.T.M. members, 60 cents.

Bibliography with all Supplements, $6.75; to members, $5.25.

Metal Cleaning Abstracts

The preparation of this new publication was a stupendous task and the book has been made possible only by the intensive efforts of Jay C. Harris, Monsanto Chemical Co., who is now the Secretary of A.S.T.M. Committee D-12 on Soaps and Other Detergents.

This new book should be of widespread interest to all those concerned with metals and their surfaces and cleaning. It makes available in compact form a tremendous amount of information on the subject.

In 1943 the task of getting together the data on metal cleaning was started by Mr. Harris, with Robert B. Mears, the early work being concentrated on aluminum cleaning. Subsequent issues of the "Annotated Bibliography of Aluminum Cleaning" were made and eventually other metal cleaning work was covered and supplements were issued. With interest in the subject definitely on the increase, it was felt a more systematic treatment was desirable and Mr. Harris has consolidated all the previous material, added a large group of additional references and prepared several indexes.

This 72-page publication, in heavy paper cover, includes four helpful indexes as follows:

Subject Index
Author Index
Specification Index
Patent Index

The references are arranged first by year and then by author and they are numbered consecutively with specific numbering sequence. There are almost 500 references and abstracts. As far as possible original articles have been abstracted, but some material are re-abstracts from other journals.

Members can order the Metal Cleaning Bibliography at special price of $2, the list price to nonmembers being $2.75.

Mattiello Memorial Book Collection

EARLY in May, the Mattiello Memorial Committee sponsored by the New York Paint and Varnish Production Club presented to the Polytechnic Institute of Brooklyn from which the late Dr. Mattiello had graduated a special collection of books and literature on surface coatings as a permanent memorial to him. A number of A.S.T.M. members had an active part in connection with the memorial and the Society was pleased to contribute some of its publications for the collection. The New York Club plans each year at its May meeting to present new books for the collection.

Dr. Mattiello had been a very active member of A.S.T.M. for many years particularly in Committee D-1 and in 1946 delivered a memorable Marburg Lecture.

ASTM Bulletin

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NINETEEN-SIXTEEN
RACE STREET
PHILADELPHIA 3, PENNA.

Standards Widely Used in Specifying and Purchasing Materials in Production and Distribution; Also in Spearheading Research

Standard Methods Aid in Improving Products and in New Developments

WHILE the strategic and economic significance of specifications and test methods has been recognized for a long time, and within the past decade there has been a very significant increase in the utilization of standards of quality, there are a multitude of uses of standards, any one of which would seem to justify the important efforts devoted to their development. It is not the purpose of this article to cover completely the importance and use of standard specifications and test methods such as A.S.T.M. has been developing for over a half century. There are many papers and reports on the subject and in fact in 1931, A.S.T.M., with the Western Society of Engineers, sponsored a significant Symposium on the Economic Significance of Specifications for Materials. This is still a pertinent discussion, with comments by leaders in their field, on the value of standards. In time of war, the importance of standards, not only in increasing production but in conservation of critical and strategic materials, is great. This is evidenced by the great activity in the work by the Armed Services, leading branches of which are active in A.S.T.M. technical committees.

One might call the preceding paragraph a dissertation on standards from the standpoint of their historic past activity and usefulness and one phase of A.S.T.M. work in standards might thus be classified. But there is another most important area of activity and usefulness that is just now being examined with intense interest by the A.S.T.M. Board of Directors and officers as indicated below.

Importance of Test Methods in Research and Developing New Products

For over five decades A.S.T.M. has been an acknowledged leader in establishing standards. Its specifications govern the quality of myriads of materials and products and its standardized methods for evaluating the properties have a world-wide use. In large measure this is the purpose of the A.S.T.M. standards,—to govern quality and testing of materials. The importance of these activities is so well recognized that thousands of the country's leading technologists, representing almost all segments of industry, devote great amounts of time and effort to keep the existing standards up to date and to meet the continually increasing demand for new specifications and tests.

Survey on Research:

But a recent survey by technical men concerned with a variety of materials and products, and at the same time active in research, leads to the inevitable conclusion that *test methods surely spearhead research.* Only when there is a satisfactory test method can new things be compared with the old. Good and reliable test methods must be a basis of improvement.

Any major work which has to do with the better use of our natural resources, with national defense, and our standard of living bears scrutiny. Research for new methods of production, new products, and new uses is in this category, and it is acknowledged by many, but little is in the literature, that standards are rapidly entering a new area of usefulness directly related to research progress.

Studies Under Way:

The A.S.T.M. Committee on Developmental Activities, a subgroup of the Board of Directors, has as one of its aims the increased promotion of the use of standards. Through publicity and in other ways the committee has done much to create a better understanding of why standards are so important. This committee believes that now industrial management and particularly administrative leaders should become better acquainted with the lation of standards to research progress.

Feeling that this concept merited some analysis before a program was developed, the committee wrote to several dozen leading A.S.T.M. members, asking for case histories of the use of test methods in research and the important part played by the development of new testing techniques, new methods of evaluting the qualities of materials, or of developing tests for measuring new qualities not heretofore measurable, which are basic and significant factors in the later development and research work which finally culminates in product or service of great value to the public.

Response Gratifying; Many Case Histories:

The response was highly gratifying to the committee, and as a part of its program to create a better appreciation of the significance of standards and research in materials a number of these case histories will be publicized. Various proposals are under study to use the information which is at hand and of which more will come.

One important development is the decision of the Board of Directors to organize a new administrative committee on this broad subject, and further announcement will be made concerning this group.

Accompanying this rather sketchy statement of a program, which is just in the course of development, there is described below an outstanding example of how a test method led to an important industrial achievement that has had a great effect on our economy. As a matter of fact it affects the daily lives of every one of us. This has to do with so-called "knocking" in internal combustion engines.

Further examples from the interesting and significant communications on the subject will appear from time to time, and the new administrative committee, in collaboration with the current developmental committee, will undertake various steps to achieve the goal that has been set. Obviously this is not a short-time project, but involves a step-by-step movement toward the objective.

If any members of the Society would care to submit examples, with discussion, of new products or important research in which standard test methods have had a significant and important part, the Board of Directors would welcome such discussions. Not all will be published and none would be used without permission of those concerned.

EDITOR'S NOTE.—This case history of where the development of a test method has led to an important industrial achievement, was submitted by Dr. Beard in a communication to the A.S.T.M. Committee on Developmental Activities which had requested his comments. It is one of a number of case histories which it is hoped can be published in the ASTM BULLETIN. Dr. Beard is a member of the A.S.T.M. Board of Directors, and is Chemist, Socony-Vacuum Oil Company, Inc.

Test Methods and Research

By L. C. Beard, Jr.

BEFORE discussing what, in my opinion, is one of the outstanding instances of where the development of test methods has led to an industrial achievement of real merit to our economy, I would like to note that when I was attending Professor Joseph S. Ames' class in Physics at Johns Hopkins, I clearly recall a favorite statement of his to the effect that until you had assigned numbers to phenomena, you had said nothing. Test methods in my opinion are simply a standardized means of assigning numbers, and it is such numbers that constitute scientific data in the more precise sciences. So much for generalities; now to our specific example.

Detonation (Knocking), Improved Fuels, Knock Testing

The phenomenon of detonation (knocking) in internal combustion engines had long been recognized by such men as Ricardo and Kettering, and it was early known that certain fuels, such as benzol, were very much less prone to knock than other fuels, such as straight run paraffinic type gasoline. Some progress was made by Midgley and Boyd on methods of measuring the tendency of fuels to knock. The technique then, as well as today, consisted in measuring the knocking tendency of the unknown fuel in a standardized engine under standardized conditions and comparing the knocking tendency of the unknown with that of blends of known fuel—one prone to knock, and one relatively free from knocking. As stated, the general scheme remains the same today, but with much improvement and refinement.

The earliest stumbling block was the selection of standard fuels for purpose of comparison and expression of results. Blends of straight run gasoline and benzol were used and the results were expressed as "benzol equivalents"; blends of straight run fuels and aniline were used and the results expressed as "aniline numbers"; blends of xylidine were used. Industry was embarrassed by too many so-called standard fuels, none of which was uniform or very carefully controlled. The situation was chaotic.

In the fall of 1926, Dr. Graham Edgar (now Vice-President, Ethyl Corp.) presented a paper before a meeting of the American Chemical Society, recommending the use of two pure hydrocarbons, namely normal heptane and isooctane (2,2,4-trimethylpentane), as the standard fuels to be used in knock comparisons. Methods of manufacture of these fuels of adequate purity were available. Their initial cost, however, was high—as we recall it, of the order of $20 to $25 per gallon. Despite this, industry promptly adopted these fuels as primary standards. Normal heptane was assigned 0 octane number, and isooctane 100 octane number. Hence, today when we speak of octane number we simply mean the per cent of 2,2,4-trimethyl pentane dissolved in normal heptane which matches in knock intensity the unknown fuel when tested in a standardized engine and under carefully prescribed conditions.

Interesting Story:

Now the most interesting part of the story begins. A major bar to increasing the efficiency of an internal combustion engine by raising the compression ratio is that this is accompanied by an increasing tendency to knocking. The automotive industry began seriously to look at this isooctane and said in substance if we had such a fuel we could increase compression ratios and realize important economies. The petroleum industry on its part began seriously to look at isooctane and said if we can make this material cheaply and in large volume, an important contribution will have been made. The efforts of both industries were crowned with success, and today by rearrangement of the hydrocarbons present in crude petroleum the petroleum industry has been able to make fuels containing large percentages of isooctane.

In fact, during the last war in the neighborhood of a half million barrels per day of 100 octane number aviation gasoline were produced. Undoubtedly, the availability of such high-quality gasoline in such an enormous amount was an important factor in winning the war. In our peacetime economy the same techniques are being used to improve the quality of the fuels used, both by the motoring public and by our airlines. With reference to Mr. Kettering's 12:1 compression ratio engine, high octane number fuels are necessary for the operation of such an engine with its attendant economies.

In connection with the development of knock test methods for fuel, it is interesting to note that the efforts of many individuals and contributing societies have finally culminated in the publication of "A.S.T.M. Manual of Engine Test Methods for Rating Fuels 1948." This 320-page book and its Supplements are devoted exclusively to methods of knock testing of fuels.

Siam University Uses Standards Book

THE publications issued by the Society are distributed and used all over the world. Hardly a day goes by when there are not several shipments of publications to various parts of the globe. The Book of A.S.T.M. Standards is undoubtedly the most widely distributed book, although the *Proceedings* and many of the special technical publications reach many distant points.

We were interested recently in noting an order from Siam for the compilation of Selected Standards for Students in Engineering which book is widely used in this country in engineering and technical schools, particularly in courses involving materials, testing laboratory, etc. The Dean of the College of Engineering at Chulalongkorn University, Bangkok, Siam heard about the book, and when he had the opportunity of reviewing a copy, obtained copies to be used by students in his courses. Whether Bangkok is the farthest point from A.S.T.M. Headquarters, we do not know, but the books did some traveling before they got there. We are *sure* the books will be of real service to the students.

"Tall" Oil

IN A recent bulletin by Dr. Arthur Pollak, Tall Oil Association and A.S.T.M. member, an interesting derivation item is revealed concerning the term "tall oil." After a reference to A.S.T.M.'s definition (from D 804 – 46 T)—A.S.T.M. has issued also test methods (D 803 – 44 T)—the following explanation was given:

"Tall is Swedish for pine. In Sweden where the material was first investigated, tall oil is known as "Talloja." It was not practical to translate this into English since we already have a commodity known as pine oil. Consequently, it became tall oil."

Numerous District Meetings Planned

Interesting Subjects to Be Covered

Most of the District Councils have been developing plans for meetings they will sponsor in their respective districts. All members and committee members in the respective areas will receive in advance of these meetings, announcements by direct mail and the ASTM Bulletin will continue to carry advance news of the meetings when the information is received sufficiently early to tie in with the Bulletin issues.

The following information will be of interest to many of the members, and specifically to those in the districts affected.

Philadelphia District—Quality Control, Research, Stress Analysis, Air Pollution:

At a long evening session at Chairman Schaefer's home on August 2, twenty of the members of the Philadelphia Council reviewed plans for the coming year and discussed participation of the district in the 1950 Annual Meeting which will be held in Atlantic City during the week of June 26. This meeting is in Philadelphia "home" territory, for the district covers southern New Jersey, in addition to Delaware and Eastern Pennsylvania. The committee has offered again to the A.S.T.M. Board of Directors, to serve as hosts for the meeting, much as it did for the 1949 meeting. It will appoint a committee on the 1950 Photographic Exhibit, among other activities.

Four technical meetings were agreed on and two other affairs are contemplated.

Quality Control.—This meeting, to feature some phase of quality control, probably the interrelation of quality control and specification writing will be a joint one with the Philadelphia-Wilmington Sections of the American Society for Quality Control and will be held on October 12 at the Franklin Institute. Robert Burns, Bell Telephone Laboratories, Inc. will be the speaker. (Members outside the district are urged to check on this date before making the trip.) Last year's joint meeting with the A.S.Q.C. was the outstanding district meeting held and members can be assured that the speakers and subjects to be covered will be pertinent and timely.

Research.—The district last year had planned a meeting at which an outstanding research administrator was to talk on a limited phase of research involving when to start and when to stop, or who should do it, but the speaker's illness forced a cancellation. Now the district, in conjunction with the Franklin Institute, hopes to hold on December 14 a more extensive discussion with several speakers, possibly with afternoon and evening sessions, with an intervening dinner. Further details later.

Stress Analysis.—W. T. Bean, an outstanding consulting engineer on stress analysis, will be the technical speaker at a meeting on January 31, 1950, at the Benjamin Franklin Hotel, in a joint session with the local section of the Society for Experimental Stress Analysis, in which Committee A-1 will participate. The Steel Committee is having a three-day session in Philadelphia, beginning January 30, and the Philadelphia District arranged this meeting accordingly. It is hoped that the meeting can be in the form of a President's night, and President J. G. Morrow is being urged to attend and to speak at the dinner. Mr. Bean will have a demonstration type of talk with some extremely unusual and entertaining feats.

Air Pollution.—Sometime in March the district will sponsor a session on air pollution, an important topic. Last year its meeting on stream pollution was an interesting and well-attended one, and now the district "takes to the air," in what undoubtedly will be another constructive session.

The committee is hoping to join with some other technical group in a joint meeting in the Lehigh Valley district and is also studying a smoker type meeting. More on these later.

Detroit—Applying Man-Made Isotopes:

The Detroit District usually concentrates on one major technical meeting each year, and this year the council is arranging a two-session symposium on Applying Man-Made Isotopes in Industry. This is to be held on October 27 at the Rackham Building. A dinner will be held between the sessions. Final details of the program are not available

Schedule of A.S.T.M. Meetings

Date	Group	Place
September 19–20	Board of Directors	(A.S.T.M. Headquarters)
September 22	Committee C-8 on Refractories	Bedford Springs, Pa.
September 22	Committee C-21 on Ceramic Whitewares	Bedford Springs, Pa.
September 22–23	Committee D-15 on Engine Insulating Anti-Freezes	New York, N. Y.
September 26–28 (Tent.)	Committee C-16 on Thermal Insulating Materials	Williamsburg, Va.
September 29–30	Committee C-19 on Structural Sandwich Construction	(A.S.T.M. Headquarters)
October 6 (Tent.)	Technical Coordinating Committee for the Paint Industry	(A.S.T.M. Headquarters)
October 6–7	Committee D-10 on Shipping Containers	Detroit, Mich.
October 10–14	1949 Pacific Area National Meeting	San Francisco, Calif.
October 11–12 (Tent.)	Committee B-8 on Electrodeposited Metallic Coatings	Chicago, Ill.
October 12	Philadelphia District	Philadelphia, Pa.
October 17–18	Committee D-14 on Adhesives	(A.S.T.M. Headquarters)
October 19–21	Committee D-13 on Textiles	Philadelphia, Pa.
October 27	Detroit District	Detroit, Mich.
November 3	St. Louis District	St. Louis, Mo.
November 7 (Tent.)	Western New York-Ontario District	Buffalo, N. Y.
December 14 (Tent.)	Philadelphia District	Philadelphia, Pa.
January 30–February 1	Committee A-1 on Steel	Philadelphia, Pa.
January 31	Philadelphia District	Philadelphia, Pa.
February 27–March 3	Committee Week and Spring Meeting	Pittsburgh, Pa.
June 26–30	53rd Annual Meeting and 9th Exhibit of Testing Apparatus and Equipment	Atlantic City, N. J.

as this article goes to the printer, but the tentative program looks like this:

Afternoon Session

A—Significant and Historical Backgrounds on Isotopes—Dr. Theo. M. Switz

B—Tracer Elements in the Inorganic Field—Dr. Harrison Brown

Dinner—Charles F. Kettering

Evening Session

C—Radio Active Isotopes in the Organic Field—Dr. Wildon Brown

D—Cautions and Precautions in the Use of Radioactive Isotopes—Dr. Wendell Peacock.

Reservations for the dinner should be made promptly with A. J. Herzig, Climax Molybdenum Co. of Michigan, Inc., 14410 Woodrow Wilson Ave., Detroit 3, Mich. The dinner price as yet is undetermined.

As is the case with all district meetings, a cordial invitation is extended to all members to attend this Detroit session, but be sure to make dinner reservations as early as possible.

St. Louis—Major Sources of Energy:

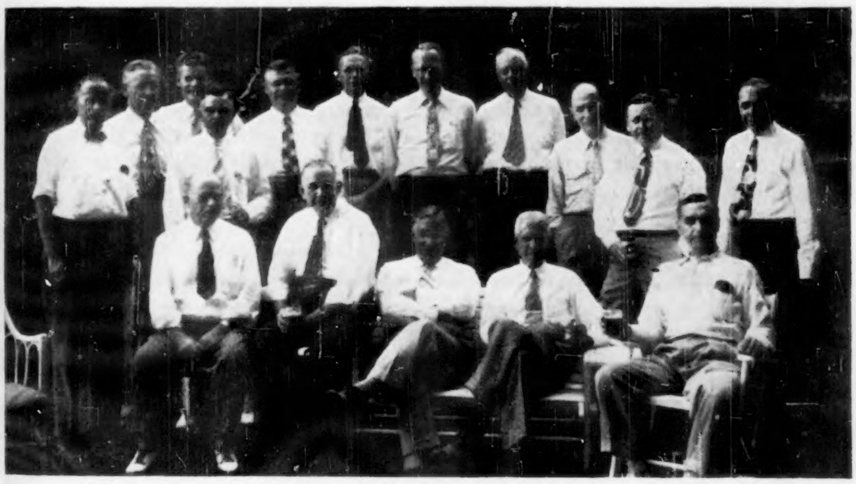
The St. Louis District is arranging a joint meeting with the Engineers Club of St. Louis for Thursday, November 3. Eugene A. Ayres, of the Gulf Research & Development Co., Pittsburgh, has accepted the invitation to be the technical speaker and will discuss the Major Sources of Energy. This paper which was given at other district meetings last year, and which has aroused much interest, was an outstanding feature of the Annual Meeting of the American Petroleum Institute.

Other Districts:

The New York District is planning a series of meetings. New England likewise has some in prospect, one, undoubtedly, to be in Hartford. The Northern California District, thoroughly represented in the General Committee on Arrangements and the other committees for the Pacific Area National Meeting, October 10–14, is devoting intensive efforts to that affair. Further details are given in this BULLETIN.

Western-New York-Ontario has set November 7, as a tentative date for a President's Night and Smoker when President Morrow's "home" district will pay its respects to him.

Annual Meeting Entertainment Group. These men, all active in the Philadelphia District, were responsible for the excellent entertainment and ladies' program featuring the 1949 Annual Meeting in Atlantic City. From *l. to r.*, E. K. Spring (Finance), E. J. Albert (Dinner), Howard C. Phelps (Ladies' Entertainment), A. O. Schaefer (District Chairman), Tinius Olsen, 2nd (District Secretary), and L. Drew Betz (Dinner Entertainment).



Philadelphia District Council Meets to Plan '49–'50 Program; *L. to r.*, E. K. Spring, Henry Disston & Sons, Inc.; T. C. Brown, City of Philadelphia, Dept. of Wharves, Docks & Ferries; Henry Grinsfelder, The Resinous Products Div. of Rohm & Haas Co.; C. R. Hutchcroft, Asbestos Cement Products Div., Keasby and Mattison Co.; H. W. Stuart, U. S. Pipe and Foundry Co.; R. W. Orr, RCA Victor Corp.; Gustaf Soderberg, American Electroplaters Society; H. S. Phelps, The Philadelphia Electric Co.; Percival Theel, Philadelphia Textile Institute; Tinius Olsen, 2nd, Tinius Olsen Testing Machine Co.; L. Drew Betz, W. H. & L. D. Betz. Seated, *l. to r.*, J. J. Moran, Kimble Glass Div., Owens-Illinois Glass Co.; E. J. Albert, Thwing-Albert Instrument Co.; H. M. Hancock, The Atlantic Refining Co.; F. G. Tatnall, Baldwin Locomotive Works; and A. O. Schaefer, Midvale Co.

This photograph is of interest also because it is an example of the influence of the Philadelphia area in the instruments field, Messrs. Moran, Albert, Tatnall, Olsen, and Betz being affiliated with leading instrument and laboratory manufacturing companies.

Using Standards in Laws and Ordinances

FOUR papers analyzing the question "How Can Nationally Recognized Standards Legally Be Used in State Laws and Local Ordinances?" are included in a booklet issued by the American Standards Association. The booklet is a report of the ASA Committee on Model Laws and Ordinances which is asking for comments and suggestions on the various methods proposed for legal recognition of national standards.

The papers show how lack of uniformity in technical requirements increases costs to industry and to the public, and reduces public safety. They analyze the need for legal methods that will permit widespread use of standards; summarize the present status of the "adoption by reference" method; and discuss the legality of several methods that have been followed in using national codes and standards as a basis for local regulations.

In addition, excerpts are included from several model statutes and ordinances proposed by organizations that have been working on the problem. The National Electrical Manufacturers Assn., the National Institute of Municipal Law Officers, the Pacific Coast Building Officials Conference, and the Council of State Governments have all made proposals on the subject.

Copies of the publication can be obtained from the American Standards Association, 70 East 45th St., New York 17, N. Y., at $1.

Revised Card Index File of X-Ray Diffraction Data for Identification of Crystalline Materials to Be Issued Soon

Second Supplemetary Set to be Included; over 4000 Cards Necessary

For the past several years the Joint Committee on Chemical Analysis by X-Ray Diffraction Methods of the A.S.T.M., A.S.X.R.E.D., and the British Institute of Physics has been actively engaged in revising its card index file which has been out of print since 1947. The card file consisted of an original set of 4000 cards issued in 1941 and a supplementary set of 4500 additional cards issued in 1944. The cards contained the complete diffraction pattern with relative intensities as well as some crystallographic data. In the upper left-hand corner of each card appeared the values for the three most intense lines on the diffraction pattern with corresponding relative intensities. Three cards for each diffraction pattern were included in the file, one card having the value for the strongest line at the extreme upper left, one having the value for the second strongest line at the extreme upper left and one with the value for the third strongest line appearing at that position. The cards were then filed in straight numeric sequence.

Several developments have lead to the revision. Enough data on new patterns have been received to justify issuing a second supplementary set, numerous corrections have been received for the old patterns, and it was felt that more crystallographic data, more complete information on the X-ray setup, and optical and other data where available should be added to the cards.

Much Work Involved:

The work of revising the old cards and assembling data for the new cards has been centered in the X-ray laboratory of the School of Chemistry and Physics, Pennsylvania State College, under the direction of Dr. Wheeler P. Davey. It has been a tremendous task to assemble all the data, classify them, check the authenticity and accuracy, and to make the data as complete as possible. On behalf of the British Institute of Physics, Prof. A. J. C. Wilson has taken new X-ray diffraction patterns, and has combed the literature for still other data. Dr. Davey, his secretary, a typist employed full time for the work, and a student employed part time during the school year and full time during the school summer vacations have handled most of the detailed work of the project. In addition the cards for minerals and for inorganic compounds have been reviewed by Prof. T. F. Bates and his associates of the Penn State Dept. of Minerology. Various members of the Joint Committee have entered into the work from time to time.

New Cards:

The revised issue of the card index file will consist of an original set, a first supplementary set, and a second supplementary set. One card only will be issued for each diffraction pattern, and there will be approximately 1350 cards in each of the three sets. Two examples of the new format for the cards are illustrated on this page. In the upper left-hand corner appear the values for the three strongest lines of the diffraction pattern as well as the value for the line of greatest spacing, with the relative intensities of the lines appearing immediately below. Proceeding down the left-hand side of the cards appear blocks for data on (1) X-ray setup, (2) crystallographic information, (3) optical information, and (4) additional information such as source of mineral, method of preparation, heat treatment, etc. On the upper right-hand side of the card appears a block for the material the pattern represents. This block will contain the chemical formula in its upper left-hand corner with the chemical name immediately below. For the benefit of mineralogists and metallurgists, where applicable in this block, the mineralogical formula will be given in the upper right-hand corner with the mineralogical name immediately below. For many organic substances the structural diagram will be shown in this space. The remainder of the right-hand side of the card contains the diffraction pattern including columns for "*d*," relative intensity and Miller indices.

All these data will not be entered in every card. When available, they have been included.

The cards in each set will not be arranged in simple numeric sequence as before, but will be separated into Hanawalt groups in the following manner:

"*d*" in Angstrom Units	Hanawalt Groups
Under 0.80...	one group
0.80 to 1.00..	grouped in steps of 0.1 A°
1.00 to 3.50..	grouped in steps of 0.05 A°
3.50 to 5.00..	grouped in steps of 0.1 A°
5.00 to 6.00..	grouped in steps of 0.25 A°
6.00 to 10.0...	grouped in steps of 0.50 A°
10.0 to 11.0...	one group
11.0 to 12.0...	one group
12.0 to 14.0...	one group
14.0 to 16.0...	one group
16.0 to 18.0...	one group
18.0 to 20.0...	one group
20.0 and over..	one group

Spacers will be provided for these groups in the card index file.

In preparing a Hanawalt group, all the cards with a "*d*" value for their strongest line within this one group will be listed somewhere in the group. The order of sequence in each group will be that of the numeric value for the second strongest line. Arranging the cards in groups such as this eliminates some of the uncertainty which occurs in measuring lines on the diffraction pattern, assigning the lines relative intensities, then trying to find an exactly comparable pattern in the card file.

An index covering all three sets is under way which will be furnished to (1) purchasers of all three sets, or (2)

Example of Card for a Mineral

d	4.03	2.47	2.84	4.03	α-SiO₂ ALPHA SILICON DI OXIDE	α-SiO₂ ALPHA CRISTOBALITE
I/I₁	100	80	70	100		

Rad. λ 1.7902 Filter Fe_2O_3
Dia. 143.2MM Cut off Coll.
I/I₁ VISUAL d corr. abs.?
Ref. CLARK, J.AM.CER. SOC., 29, 25 (1946)

Sys. ORTHORHOMBIC S.G. V^4 $P2_12_12_1$
a_0 7.00 b_0 7.00 c_0 7.00 A C
α β γ Z 8
Ref. WYS

ε α n ω β ε γ Sign
2V D 2.32^{0}mp Color COLORLESS
Ref. C.C.

1ST FIRING: HEATED 4 HRS. TO 1500°C, HELD FIVE HOURS.
2ND FIRING: HEATED 3 HRS. TO 1400°C, HELD THERE 24 HOURS.
WYS CALLS α-CRISTOBALITE THE LOW TEMP. FORM. FROM FIRING DATA, MATERIAL IS PRESUMABLY HIGH (OR β) CRISTOBALITE? CARD IS FOR LOW (OR α) FORM.

d Å	I/I₁	hkl	d Å	I/I₁	hkl
4.03	100		1.39	10	
3.13	60		1.36	10	
2.84	70		1.35	10	
2.47	80		1.34	10	
2.45	10		1.33	20	
2.10	20		1.29	20	
2.01	20		1.28	20	
1.92	40		1.23	10	
1.86	40		1.22	10	
1.75	10		1.20	10	
1.72	10		1.18	10	
1.68	20		1.17	10	
1.63	10		1.16	10	
1.60	40		1.10	10	
1.59	10		1.09	20	
1.56	10	SEE ALSO	D = 3.99	3.19	2.50
1.52	20		4.30	4.08	3.81
1.49	20		3.35	1.813	1.536
1.43	20				
1.41	10				

purchasers of the second supplementary set who have purchased the original and supplementary sets issue' in 1941 and 1944—one index only per · urchaser. The numeric index will include listings arranged in Hanawalt groups with three variations for the three strongest lines in each pattern as follows:

first, second, third
second, first, third
third, first, second

Prices have not yet been decided upon but an approximate price for the 3 by 5-in. cards is indicated of about $135 *each* for the original, first supplementary, and second supplementary sets, with lower prices for additional sets, and refunds or credits if the earlier sets were purchased. Credit will be given when the earlier sets are returned.

In addition to the 3 by 5-in. cards the Committee is considering sets of 4 by 6-in. cards of the keysort variety, coded for mechanical sorting. It has not yet been decided definitely to issue this type of card file because preliminary studies of the demand for the cards at the price necessary to cover cost of printing, coding, etc., which would be quite a bit higher than the 3 by 5-in. cards, at present does not seem to warrant issuance.

Joint Committe on X-ray Diffraction Establishes Research Associateship

UNDER the sponsorship of the A.S.T.M., the Joint Committee on Chemical Analysis by X-ray Diffraction Methods, of the A.S.T.M., A.S.X.-R.E.D., and British Institute of Physics has established a research associateship at the National Bureau of Standards effective July 18, 1949. Miss Eleanor Tatge has been named to fill the associateship.

The duties of Miss Tatge will be to review conflicting data in the card file of X-ray diffraction patterns issued by the Joint Committee and undertake the selection of correct patterns or to make new patterns of standard material when required. The research associate will be under the direct supervision of H. F. McMurdie, Chief of the Constitution and Microstructure Section of the Division of Mineral Products. The direction of the work is vested in a special group appointed by the Joint Committee consisting of W. L. Fink (Aluminum Company of America) as chairman, with L. L. Wyman (General Electric Co.), W. P. Davey (Pennsylvania State College), and L. K. Freväl (Dow Chemical Co.).

The present contract covers only a one-year period for the research associateship. Another special group of men has been appointed by the Joint Committee to raise funds for carrying on the associateship at the expiration of the present contract, if it seems desirable to do so. This group consists of L. K. Freval as chairman and W. L. Fink, L. L. Wyman, F. W. Matthews (Canadian Industries, Ltd.), and R. E. Hess, A.S.T.M. Technical Secretary.

A.S.T.M. and Quality Control Society Cooperate

ACTING on a suggestion from Harold F. Dodge, Chairman of A.S.T.M. Committee E-11 on Quality Control of Materials, the Board of Directors has approved a procedure involving cooperation between the American Society for Quality Control and A.S.T.M. through Committee E-11, which would involve, among other things, the approval and endorsement by the A.S.Q.C. of individual sections of the revised and enlarged manual on Quality Control of Materials. The revision and amplification of this manual is one of the major projects in Committee E-11 and intensive work is under way. Many of the members of Committee E-11 are active in A.S.Q.C.

Another cooperative venture might be noted in the outstanding meeting held in Philadelphia in February, 1949, under the joint auspices of the A.S.T.M. Philadelphia District and the local chapter of A.S.Q.C. Another joint meeting is being planned for October, 1949.

Non-Destructive Testing Work Concentrated in Committee E-7

AS INDICATED in the Annual Report of the Board of Directors, the scope of Committee E-7, which for many years concerned radiographic testing, has been expanded to include the much broader field of nondestructive testing generally. After lengthy consideration in the committee, and consultation with other A.S.T.M. technical groups interested, the following scope has been approved by the Board:

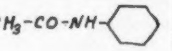
Promotion of knowledge and advancement of the art of nondestructive testing of engineering materials for discontinuities or structural irregularities, and extensions of the methods used to other engineering problems; the formulation of requirements relating to the performance, interpretation, and classification of results of such tests, without prejudice to the jurisdiction of product committees over their respective products; and the coordination and review of nondestructive testing clauses initiated by other committees.

Organized in 1938, the committee has a number of notable accomplishments including the Symposium on Radiography held in 1943, numerous round-table sessions and discussions, and a number of separate technical papers. Last year in Detroit, the committee arranged a round-table session on Ultrasonic Testing, and in June, at the 1949 A.S.T.M. Annual Meeting, it sponsored two sessions, one including a series of papers on Radiography, and another session devoted to Ultrasonic Testing. It is expected that these papers will be published in book form later in the year.

The committee has studies under way of a standard radiographic procedure to replace one that was withdrawn some years ago. Revisions of definitions of terms, E-52, have been completed, and studies are being made of a possible set of X-ray negatives to cover defects in steel welds, similar to the set covering steel castings, E-71.

Example of Card for an Organic Compound.

d	9.44	5.94	3.68	9.44	$CH_3CONHC_6H_5$
I/I_1	100	80	60	100	ACETANILIDE



Rad. λ 2.29 Filter
Dia. Cut off Coll.
I/I_1 d corr. abs.?
Ref. CIL

Sys. ORTHORHOMBIC S.G.
a_0 b_0 c_0 A C
α β γ Z
Ref.

εα nωβ εγ Sign
2V D 1.21 mp 114° Color
Ref. HCP

B.P. 305°

d Å	I/I_1	hkl	d Å	I/I_1	hkl
9.44	100		2.81	15	
6.68	50		2.76	5	
6.35	5		2.67	10	
5.94	80		2.58	15	
5.11	50		2.53	15	
4.85	5		2.47	10	
4.69	10		2.43	5	
4.42	30		2.39	2	
4.30	30		2.36	20	
4.25	2		2.26	20	
4.05	20		2.20	5	
3.97	30		2.17	10	
3.88	20		2.05	10	
3.68	60		2.02	10	
3.60	30		1.94	10	
3.43	60		1.91	10	
3.28	15				
3.19	20				
3.04	5				
3.01	25				

Great Many Standardization Projects in Technical Committees

Much Activity Under Way on Numerous Materials

IN EACH August issue of the ASTM BULLETIN in recent years there has been given a "round-up" of important standardization activities which may be under way in the various technical committees. This article will from now on be included in our September issue. The material which follows provides some conception of the great amount of work in progress. The information is based in part on current reports of the technical committees, and in large measure on statements of programs of work which the technical committee officers have been asked to send to Headquarters. Much of this information is of interest to the membership broadly, and it is a great help to the Staff and to the Administrative Committee on Standards in providing a look-ahead.

Arrangement of Material

The material which follows is arranged in general in the order of the designations of the Technical Committees, the "A" and "B" groups, Ferrous and Non-Ferrous appearing first, followed by the "C," "D" and "E" groups.

Ferrous and Non-Ferrous Metals—"A" and "B" Committees (see also "E" Groups)

A-1 Steel

Committee A-1 has received numerous requests for A.S.T.M. specifications for products which have not previously been covered. Now under way in the various subcommittees are specifications for the following items:

1. Steel castings for steam turbine castings.
2. Cold-drawn alloy steel bars.
3. Steel piling.
4. Alloy steel seamless drum forgings.
5. Quenched and tempered steel bolts and nuts with suitable nuts and plain washers.
6. Heat-treated locomotive driving tires.

Subcommittees II on Structural Steel and XI on Steel for Boilers and Pressure Vessels will through a joint subgroup investigate the present methods of specifying yield point and elongation requirements, and will present a report with recommendations for a uniform system in these two subcommittees.

Two specifications for hot-formed and heat-treated steel springs, A 125 for Helical and A 147 for Elliptical Springs, are now under extensive revision since it is proposed to title them "Leaf" Springs. In both specifications, requirements for Brinell hardness are to be added. In addition, various revisions have been made in the sections on permissible variations and on finish (a provision for shot peening individual spring leaves has been added).

The Tentative Specification A 305 for the Minimum Requirements for the Deformations of Deformed Steel Bars for Concrete Reinforcement is being revised, the revision having been endorsed by representatives of the American Concrete Institute, American Association of State Highway Officials, and other groups. It is proposed, subject to favorable vote in Committee A-1, that the specification be advanced to standard when the revisions are made. The revision involves a slight change in the spacing requirements of deformations which is proposed to be changed to a maximum of 0.7 of the nominal size of the bar.

Thirteen forging specifications which have been extensively revised in the past two years have been approved by committee ballot and, after some slight editorial modifications, will be submitted to the Society for approval.

A joint group of Subcommittees IX on Steel Tubing and Pipe and XXII on Valves, Fittings, Pipings, and Flanges for High-Temperature and Subatmospheric Temperatures have agreed upon a tentative specification for steel pipe for low-temperature service and also one for steel tubes for low-temperature service. It is expected these will be published within the next year. Subcommittees IX and XXII have also prepared a manual on physical testing of tubular products. This is being distributed to the various interested members of Committee A-1. It is proposed to submit this manual to Subcommittee XIII on Methods of Tests of Committee A-1 for their approval and recommendations on the method of publishing the information.

A proposed general requirement specification for steel for boilers and other pressure vessels as well as revisions of three of the basic boiler plate specifications in line with the new general requirement have been approved by committee ballot. It is proposed that the remaining specifications under the jurisdiction of Subcommittee XI be revised in a like manner, and all these will then be referred to the Society.

Subcommittee XV on Steel Bars has prepared a testing manual similar to that of Subcommittee IX mentioned previously. This document will cover mechanical testing procedures and definitions for steel bars, and also will be submitted to Subcommittee XIII on Methods of Tests.

Specifications A 108 for Cold-Finished Carbon-Steel Bars and A 107 for Hot-Rolled Carbon-Steel bars are being revised so that the chemical requirements for various grades will agree with the latest manufacturing practice.

A proposed specification consolidating the essential grades found in the present Specifications A 157 for Alloy-Steel Castings for Values, Flanges, and Fittings for High-Temperature Service and A 217 for Alloy-Steel Castings Suitable for Fusion Welding for High-Temperature Service is under consideration. A revision of Specification A 158 for Seamless Alloy-Steel Pipe for High-Temperature Service which concerns the deletion of all reference to austenitic steel is also under way.

Tentative Specification A 307 for Steel Machine Bolts and Nuts and Tap Bolts is being revised by Subcommittee XXVI on Common Bolting. The most important change is the inclusion of another grade of bolt which would have a minimum tensile strength of 55,000 psi. with a maximum tensile strength of 90,000 psi. The purpose is to include a type of bolt commonly used in the valve and fittings industry.

A-3 Cast Iron

The Subcommittee on Pig Iron, of Committee A-3, has completed a revision of the Tentative Specification for Foundry Pig Iron (A 43) which, after committee letter ballot, will be submitted to the Society.

The Subcommittee on Methods of Testing has just completed a questionnaire survey on methods of taking Brinell hardness of gray iron and is preparing a proposed standard for such tests. The subcommittee also expects to complete during the current year methods for determining the modulus of elasticity of gray iron. The

PHOTOGRAPHS—From time to time photographs of technical committee officers are used in the BULLETIN. Some of the 1948-1949 officers have been in previous issues. More are presented here.

Subcommittee on Impact Testing has completed several methods for impact testing of gray iron which also will be submitted to the Society.

The Subcommittee on Chilled and White Iron Castings is developing suitable specimens for the testing of the white, transition, and gray iron zones in chilled iron castings and will shortly submit a report thereon.

The Subcommittee on Elevated Temperature Properties of Cast Iron has just completed a recommended revision of the Tentative Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 F. (A 278) which will make it a document more useful to the A.S.M.E. Boiler Code Committee. At the June meeting research activity relative to the elevated temperature testing of gray iron was discussed and the committee is completing detailed plans for a research program for high-temperature testing.

The committee also expects to establish a new subcommittee dealing with the subject of permanent mold gray iron castings.

A-5 Corrosion of Iron and Steel

Committee A-5 is studying a revision of the method of determining the weight of zinc coatings in which a 1:1 hydrochloric acid is used instead of concentrated acid (A 90). An investigation is also being made of an alternate for the present concentrated sulfuric-acid method of determining the weight of coating on terne plate and tin plate. An effort will be made to develop field conformance tests as alternates for lengthy, time-consuming laboratory tests.

Tentative Specifications for Zinc-Coated (Galvanized) Iron or Steel Sheets (A 93) and for Long-Terne Sheets (A 308) will be revised to include sheets coated in coils.

A new specification is being prepared for high-tensile strength telephone and telegraph-line wire. This will necessitate a revision of the existing Specification for Zinc-Coated (Galvanized) Iron or Steel Telephone and Telegraph Line Wire (A 111). Revisions are also contemplated in the following three specifications:

(a) Zinc-Coated (Galvanized) Iron or Steel Wires (A 112),
(b) Zinc-Coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-Way Wire Fencing (A 116), and
(c) Zinc-Coated (Galvanized) Iron or Steel Barbed Wire (A 121).

The first of these three specifications will be reviewed and brought up to date so as to be in agreement with present practice, while the other two will be revised to indicate clearly the designs and weights of coatings of fence and barbed wire which are readily available and those which are specials.

At the recent meeting of the subcommittee on Sheet Specifications, it was decided that a draft of a specification should be prepared for galvanized roofing sheets of various gages but all with the same weight of zinc coating.

Committee A-6 on Magnetic Properties: ***l. to r.;*** **R. L. Sanford, Chairman; B. M. Smith, Vice-Chairman; J. P. Barton, Secretary.**

There seems to be little, if any, need for continuing the Tentative Specifications for Lead-Alloy Coating (Hot-Dip) on Iron or Steel Hardware (A 267) and, therefore, a recommendation will probably be made to drop this specification.

A-6 Magnetic Properties

Committee A-6 on Magnetic Properties is planning its work on the basis of its newly reorganized subcommittee structure. The new subcommittees will be small, with only three to six members directly assigned, but it is understood that each subcommittee chairman can call on any other members of the committee who can help in any particular assignment. The four new subcommittees established are (1) Nomenclature and Definitions, (2) Methods of Sampling and Test, (3) Editorial, and (4) Accuracy of Standard Test Methods. The subcommittee chairmen, together with the officers of the committee, will comprise the Advisory Committee.

A-7 Malleable-Iron Castings

The major task confronting Committee A-7 is to achieve a satisfactory consensus on revisions of two of its tentative specifications: for Pearlitic Malleable Iron Castings (A 220) and for Malleable Iron Flanges, Pipe Fittings, and Valve Parts (A 277).

On the first of these, there are questions involving the correct ratio of yield strength to tensile strength, the accuracy of some of the Brinell values now given, and how Brinell readings should be taken. With respect to the second specification, which permits the products to be made of cupola malleable iron (A 197) or of air-furnace, open-hearth, or electric-furnace malleable iron (A 47) there remains to be settled the conditions under which one or the other of the two basic specifications shall be followed.

A-9 Ferro-Alloys

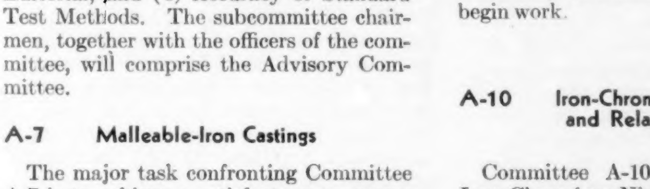
As noted in the July Bulletin, Committee A-9 has just completed the preparation of new Tentative Specifications for Ferroboron and Ferrotitanium. These have now been accepted by the Administrative Committee on Standards as was the revision and reversion to tentative of the Specification for Molybdenum Salts and Compounds (A 146). The two new specifications will be designated A 323 and A 324, respectively.

During the current year, the committee hopes to expand its scope to cover alloying materials other than "ferro-alloys" used in mass melting operations in the steel and associated industries. When this revised scope has been worked out satisfactorily and accepted by the Board of Directors, the committee will immediately begin work.

A-10 Iron-Chromium-Nickel and Related Alloys

Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel, and Related Alloys expects during the current year to publish the revised edition of the Tables of Data and Properties of Corrosion-Resisting Steels on which it has been working. Publication has been held up pending reconciliation of the data on wrought alloys with the American Iron and Steel Institute and of the data on cast alloys, which will be included for the first time in this edition, with data of the Alloy Casting Institute.

The Subcommittee on Methods of Corrosion Testing is taking steps to procure the thousands of test specimens for its comprehensive program of atmospheric corrosion tests which, it is estimated, will be under way in about one year, using the test site locations now being arranged for



Committee A-7 on Malleable-Iron Castings: ***l. to r.;*** **W. A. Kennedy, Chairman; C. F. Lauenstein, Vice-Chairman; J. H. Lansing, Secretary.**

Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys: *l. to. r.;* J. Strauss, Chairman; L. L. Wyman, Vice-Chairman; H. D. Newell, Secretary.

by the Advisory Committee on Corrosion.

The Subcommittee on Mechanical Testing has just completed round-robin tension tests, the results of which were published in the May ASTM BULLETIN. All phases of this work have been discussed by the subcommittee, but no recommendations for specification changes will be made at this time, pending further study of the report.

The Subcommittee on Metallography continues its study of the sigma phase. The work has progressed to the point where all of the samples of the 18 per cent chromium, 8 per cent nickel steels with and without molybdenum have been exposed to high temperatures. These samples were held at 1200 to 1500 F. for 24 hr. and for 500 hr. The samples so treated have been machined and Charpy impact test specimens have been distributed to the cooperating laboratories for impact tests. After the impact tests have been completed the next step will be to distribute samples for metallographic examination and X-ray diffraction tests to determine the existence of sigma phase. This work will be carried on simultaneously with etching experiments to determine whether an etchant can be found that will identify the sigma phase by metallographic means so that it will not be necessary to resort to X-ray diffraction examination.

The Subcommittee on Specifications for Flat Products continues its study of the addition of new grades, including stabilized alloys, to Specification A 240 to meet the needs of the Boiler Code Committee for material specifications for pressure vessels.

B-1 Wires for Electrical Conductors

Committee B-1 is preparing to insert in its copper wire specifications proper references to the types of copper used, tying them in with the new Classification of Copper (B 224).

The Subcommittee on Methods of Test and Sampling Procedure is writing a suitable sampling procedure for B-1 Specifications and has prepared a preliminary draft based on statistical methods as developed by Committee E-11 on Quality Control of Materials. Extended trials now are in progress in the plants of a number of the producer members.

The Subcommittee on Conductors of Copper and Copper Alloys has started the preparation of a specification for conductors of segmental-type, single-conductor cable in sizes up to, and including, 4,000,000 cir. mil. The group is now active in the design of a suitable standard gage, ultimately to replace the slip fitting presently authorized for inspection of trolley wire, and is working on adequacy of methods of determination of weights, areas, and resistivities in all B-1 Specifications.

The Subcommittee on Conductors of Ferrous Metals has completed the draft of a specification for the steel wire used for reinforcement of aluminum conductors, of steel reinforced (ACSR) and this will be submitted to the Society. Simultaneously, a reference to it will be incorporated in the Specifications for Concentric-Lay Stranded Aluminum Conductors, Steel-Reinforced (ACSR) (B 232).

B-2 Non-Ferrous Metals and Alloys

Revisions of the ten tentative specifications for nickel, and high-nickel alloy; rods and bars, pipe and tube; and plate, sheet and strip (B 127 and B 160 to B 168, inclusive) have been under way in the Committee B-2 for several years. The work has now been completed and the revised tentatives will be submitted to the Society this Fall.

Another item of incompleted work in Committee B-2 is the possible revision of the Standard Specification for Lead-Coated Copper Sheet (B 101). In addition, the Subcommittee on Refined Copper is making a critical review and study of its copper specifications with particular reference to the specification for arsenical and argentiferous coppers, now included in the Lake Copper Specifications (B 4).

B-3 Corrosion of Non-Ferrous Metals and Alloys

Committee B-3 will be the first committee to initiate a long-term exposure program since the test sites have been under the jurisdiction of the Advisory Committee on Corrosion. The Subcommittee on Galvanic and Electrolytic Corrosion has secured the remainder of its galvanic disk specimens and these couples are expected to be on exposure soon.

The Subcommittee on Spray Testing is continuing its study of possible revisions in the salt spray method. One group will survey present information and plan a test program; another has been appointed to assemble information on the acetic acid-salt spray test as used for evaluating the quality of plated coatings on zinc-base die castings. The Subcommittee on Weather, active during the past year, is continuing its exposure of iron and zinc specimens at a number of test locations to compare the corrosivity of atmospheres at the different test sites with respect to these two metals. The number of specimens exposed at each site is sufficient for removals in groups after one-, two-, four-, and eight-year periods, so that the test will be completed in 1956. A group has been organized to prepare a summary of available information on methods of measuring atmospheric pollution.

B-4 Electrical Heating and Resistance Alloys

The Subcommittee on Electrical Heating Materials of Committee B-4 expects

This photograph shows the first test rack erected in the coordinated program of tests under the Advisory Committee on Corrosion. These particular specimens are the electrolytic and galvanic couples which work is under the direction of Subcommittee VIII of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. At the left is L. J. Gorman, Consolidated Edison Co., Chairman of Subcommittee VIII for many years, and at the right, Sal Rinaldi, one of his assistants. The location is on the roof of the Port of New York Authority Building, New York City.

to revise shortly the Method of Accelerated Life Test for Metallic Materials for Electrical Heating (B 76) to incorporate therein some recent refinements of the test method worked out at the Massachusetts Institute of Technology.

The study of "green rot" continues as a cooperative project of the subcommittees responsible for Specifications and for Methods of Test for Alloys in Controlled Atmospheres. Exploratory work on both wrought and cast alloys has been done and trials are to be run in the furnace developed for testing materials in gas atmospheres in accordance with Tentative Method of Test for Effect of Controlled Atmospheres upon Alloys in Electric Furnaces (B 181).

The Subcommittee on Thermostat Metals is conducting investigations of significant properties for development of test methods of thermostat metals. This includes hardness test methods and their use for thin thermostat metals. Recently a program has been started on invar with particular reference to methods of test using interferometer, steam and water jacket test, and the use of the automatic recorder. Specifications will be considered after the test methods have been reviewed and completed.

Radio Tubes.—The Cathode Section of the Subcommittee on Radio Tubes has dealt with the many problems pertinent to nickel cathode material for electronic tubes and has made good progress. Physical testing specifications have been reviewed, improved, and brought up to date. The bulk of the effort, however, has been in defining suitable testing methods and specifications for cathode material. Aside from physical testing, this effort has involved development of a standard diode tube as a means of testing, and development of chemical testing to aid in the definition of suitable material, and in addition studies of the effects of various impurities in cathode nickel have been undertaken on a broad scale. Its activities have been linked with that of Committee E-3 on Chemical Analysis of Metals and it is anticipated that activities will continue at a high rate for the forthcoming year.

The section of this subcommittee dealing with tungsten wire has just drafted a proposed method for sag testing. Specifications will be developed later. The Section on Particle Size is at present confining its investigation to a new testing instrument for powders commonly used in the electronic tube and lamp fields.

The Section on Life Tests of the Subcommittee on Contact Materials continues its studies of tests for the surety of making a circuit through experimentation on maximum breakdown voltage and the variation of resistance with current, and at present a test method is in preparation. The Section on Physical Properties has been active on hardness determination of contact materials. Work on a proposed method of test which involves a theoretical study of the hardness of thermostat metals is in progress, while the Section on Contact Forms is revising present standards in the light of field difficulties. The Section on Micro-Current Contacts has conducted preliminary tests and expects to start an active program of work during the next year.

B-5 Copper and Copper Alloys

As it was noted in the July BULLETIN, Committee B-5 on Copper and Copper Alloys, Cast and Wrought, completed a year of very active work and 1949–1950 will see continued activity. Among the subjects for investigation will be a possible envelope specification for dimensional tolerances and such items, and a study of alloy codification and nomenclature.

The Subcommittee on Plate, Sheet and Strip is studying requirements for bars sawed or cut from plates; the revision of the copper limits for alloys Nos. 4 and 6 in the specifications for Leaded Brass Sheet (B 121); the revision of the requirements for mechanical properties for beryllium copper in specifications B 194 and B 195; the addition of phosphor bronze alloy B2, now in the Rod and Bar Specification (B 139), to the Plate, Sheet and Strip Specifications (B 103); and the use of Rockwell hardness as a mandatory requirement.

The Subcommittee on Rods, Bars and Shapes is studying the inclusion of additional size ranges in its specifications for Copper Rods, Bars and Shapes (B 133) and the collection of Rockwell hardness data in anticipation of the future inclusion of such requirements in rod and bar specifications. The Subcommittee on Wire and Wire Rod is studying the possible revisions of requirements for tensile strength and elongation in its Beryllium Copper Alloy Specifications (B 197). The Subcommittee on Pipe and Tube has under consideration the development of requirements for automotive and refrigeration service tube, and revision of dimensional tolerances in the Condenser Tube Specifications (B 111). The temper requirements of the Copper Tube Specifications (B 75) are being reviewed as to their adequacy.

The Subcommittee on Castings and Ingots is to review the specifications for Valve Bronze (B 61) and Ounce Metal (B 62) castings and is studying the preparation of a document similar to the Code of Procedure in Inspection of Copper-Base Alloy Sand Castings adopted by the British Standards Institution in 1947. The Subcommittee on Tolerances is studying the preparation of closer straightness tolerances for slit materials, and dimensional tolerances for bus pipes and tubes. Also it is preparing revised tolerances for Specifications B 111.

B-6 Die-Cast Metals and Alloys

The major work schedule of Committee B-6 for the next year will be concentrated in two subcommittees. The Subcommittee on Exposure and Corrosion Tests has completed plans for reealling and testing its zinc and magnesium alloy test bars from nine exposure locations after ten years of aging. The laboratories of 21 members of the committee have volunteered to conduct the mechanical property tests of these specimens, and it is hoped the data can be included in the 1950 report of the committee.

The Subcommittee on Die-Casting Processes has completed its studies on aluminum alloy melting practices and will draw up a program of work to cover a study of the problems involved in the zinc-alloy die-casting process.

B-7 Light Metals and Alloys

In Committee B-7 the Subcommittee on Testing of Light Alloys will study requirements for frequency of sampling on type and location of specimens in light-alloy wrought products. This subcommittee is also considering the mechanical testing of light metal foil.

The Subcommittee on Anodic Oxidation of Aluminum has prepared a Method of Measuring Thickness of Anodic Coatings on Aluminum with the Filmeter, based on a paper, "Measurement of Thickness of Oxide Coatings on Aluminum Alloys," by Ralph B. Mason and William C. Cochran, published in the October, 1947, BULLETIN. Subject to favorable letter ballot, the committee expects to submit this method to the Society.

During the past year the new temper designations adopted by the aluminum industry were incorporated into the specifications for aluminum alloys, and they are being considered for use in the specifications for magnesium alloys.

The Subcommittee on Wrought Aluminum Alloys is working on a proposed tentative specification for die forgings.

A special subcommittee has been organized to carry out the program of atmospheric exposure testing which Committee B-7 has been planning for some time. A start is being made on the collection of test specimens.

B-8 Electrodeposited Metallic Coatings

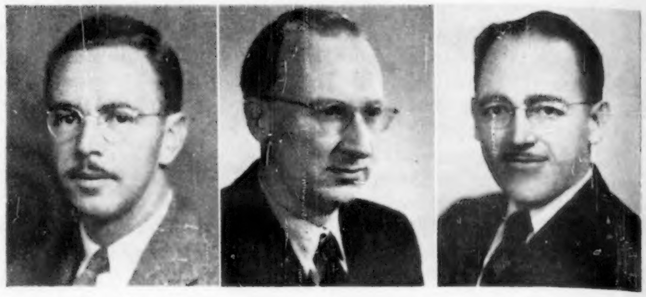
Committee B-8 now has a number of atmospheric exposure tests in progress and upon their completion expects to review the Specifications for Electrodeposited Coatings of Cadmium on Steel (A 165); for Nickel and Chromium on Zinc (B 142); and Lead on Steel (B 200). The exposure tests of copper-nickel-chromium deposits on high-carbon steel and of electrodeposited lead coatings on steel also continue.

The Subcommittee on Conformance Tests has active sections engaged in studying thickness tests; porosity tests; adhesion, hardness, and ductility tests; and luster tests. The Subcommittee on Electroplating Practice is drafting recommended practices for the preparation for plating, and for plating on zinc-base die

castings; on copper and copper alloys; on stainless steel; and on aluminum. A new section has been authorized to survey the present status of electroplating on plastics and nonconductors to determine the advisability of preparing a recommended practice.

The Subcommittee on Supplementary Treatments for Metallic Coatings has five sections which are continuing their study of various phases of chromate and phosphate coatings on zinc and cadmium. A sixth section has been organized to study and suggest testing methods for the evaluation of supplementary organic finishes on electrodeposited metallic surfaces.

Committee B-8 on on Electrodeposited Metallic Coatings; *l. to r.;* **C. H. Sample, Chairman; G. Soderberg, Vice-Chairman; R. B. Saltonstall, Secretary.**



B-9 Metal Powders and Metal Powder Products

The Subcommittee on Nomenclature and Technical Data, of Committee B-9, having completed the Tentative Definitions of Terms Relating to Powder Metallurgy (B 243–49 T) is now turning its attention to a standard tension test bar for use in testing metal powder materials. The committee is contacting interested individuals in the industry for their comments.

The Subcommittee on Metal Powders has completed a program looking to the development of a standard test for the compressibility of metal powders in which nine laboratories cooperated. A paper summarizing the results of this program will be published shortly. The subcommittee is working on test methods for the chemical analysis of metal powders in cooperation with Committee E-3 with particular emphasis on the determination of insoluble matter in iron and copper and of the "hydrogen loss" of certain powders. A third phase of the work deals with subsieve particle size analysis.

The subcommittee on Metal Powder Products is considering standard lists for recommended press fits of bearings and standard size lists for certain types of bearings. These lists will be recommended for appending to the sintered bearing specification (B 202–45 T). The need for additional specifications in the structural parts field to cover materials of compositions other than those specified in Tentative Specification B 222 is under study. It was considered that iron-carbon and iron-copper-carbon mixtures should be investigated as well as iron-copper mixtures of higher density than those now covered. The group will determine the desirability of specifications for brass and bronze structural parts, and for iron parts used in magnetic applications. Another section is working on test methods for determining the properties of cemented carbides and has set up task groups to recommend procedures for measuring hardness, transverse bend strength, microstructure, and for preparing a chart giving comparative grades of carbides.

"C" Committees—Cementitions, Ceramic

C-1 Cement

The keynote of the activities of Committee C-1 on Cement is that of performance tests. The emphasis on performance is recognized in the several reports indicating developmental work on such items as: a rapid performance test on sulfate resistance; a performance test for the analysis of cement, to replace the existing chemical analysis methods; and a method for the routine testing of time of set indicating that tests on neat paste do not approach the mortar tests for results; and minor changes in the heat of hydration test which will make this method more clear and increase its accuracy. Apparatus is having a preliminary trial for use in a proposed method to measure the bleeding and plasticity of cement, and methods to establish the durability of cements with an optimum amount of SO_3 are being considered.

The Working Committee on Volume Change is reviewing the summary of tests on alkali reactivity which will then be made available to both Committees C-1 and C-9. The Subcommittee on Additions, as an outgrowth of its five-year experience in considering air-entraining agents, now feels competent to formulate a method of test as well as a specification for requirements for all air-entraining agents. The subcommittee hopes to complete such a tentative in the very near future which when accepted will replace the present method of recognizing air-entraining agents individually. Cooperative study is continuing on the development of a specification for natural cement.

A cooperative series of tests to measure the fineness of pozzolanic materials using the Blaine fineness apparatus and the No. 325 sieve method is in progress. Also a new cooperative series of tests for measuring pozzolanic activity using several methods has been instituted.

C-4 Clay Pipe

Committee C-4 on Clay Pipe will make a general revision of the Tentative Specifications for Extra Strength Clay Pipe (C 200–44 T) during the coming year to include a new table of dimensions. A task group has been authorized to study and develop a proposed specification for ceramic glazed sewer pipe of both standard and extra strength. With the enlargement of the scope of the committee to include clay flue linings, efforts are now being made to augment the committee membership and to inaugurate a standardization program.

C-7 Lime

With the adoption of two additional specifications covering chemical lime, namely, lime for use in calcium carbide manufacture and in grease manufacture, further progress is expected during the year by Committee C-7 on Lime, in the preparation of specifications covering other chemical lime uses. A new specification is being considered for hydraulic lime. Continued activity will result following round-robin tests conducted on silica determinations, settling rates and available CaO, due to inconclusive results to date. It is planned to concentrate on the development of simpler but accurate ways of determining Fe_2O_3 and other trace elements in lime.

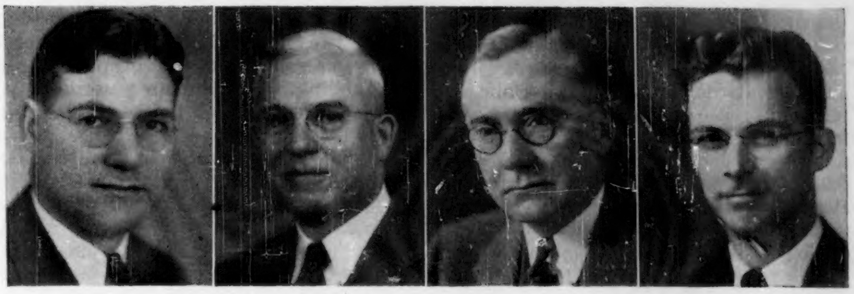
C-8 Refractories

Studies now in process on the load test and the pyrometric cone test for refractories will be continued by Committee C-8 and it will see what can be done to introduce a simpler though possibly less accurate method of measuring thermal conductivity. Increasing use of plastic and castable refractories calls for study of these materials with a view to new tests. The reaction by which carbon monoxide disintegrates refractories through deposition of carbon has never been recognized by a standard test, although blast-furnace refractories are constantly being tested for their susceptibility to such disintegration. It is hoped to have a standard test for carbon monoxide disintegration.

Differentiation of refractory products is still being studied. A type of fire brick which is high in silica, high enough so that it can be seriously considered as a silica brick with clay bond, may have to be taken out of its present classification as a

high-duty fire-clay brick and be given separate treatment, involving appropriate tests. Special refractories, such as the refractories that are made by melting in the arc furnace and casting in molds, need classification together with standardizing of the tests under the conditions of use. Carbon is being introduced as a refractory, especially in the iron-making blast furnace, and is being handled by a new subcommittee.

The work of C-8 continues to recognize the great value of its "Manual of A.S.T.M. Standards on Refractory Materials." This includes not only the information regularly published in the A.S.T.M. Book of Standards, but also a series of surveys of conditions to be met by refractories in various industries. These surveys have made the Manual a valued textbook on refractories, and efforts will be continued to make the surveys cover as wide a variety of industries as possible.



Committee C-9 on Concrete and Concrete Aggregates: *l. to r.;* K. B. Woods, Chairman; Fred Hubbard, Vice-Chairman; Stanton Walker, Secretary; F. F. Bartel, Assistant Secretary.

C-9 Concrete and Concrete Aggregates

The standardization projects in Committee C-9 fall into two categories, recognized by the organizational setup of the committee. Group II, which is the research group, restricts its activity to problems of the concrete industry. The work in this category is of necessity on a long-time basis. Evaluation of data by statistical methods in order to determine how best to apply such methods to the type of data obtained in the field of concrete has been under study with the view of making recommendations regarding the necessary frequency of sampling or testing.

The subject of chemical reactive aggregates in concrete is considered of great importance and up to the present the committee has held several well-attended meetings to learn through open discussion the ramifications of this subject. It is expected that the committee will attempt to conduct further research and a start is being made on the formulation of a general outline of the topics which seem to be involved.

There has been considerable activity concerning the durability of concrete. This subject is complex and a difficult one for which to organize comprehensive investigations. The committee will continue to collect piece-meal data for discussion which up to now has not been without results as evidenced by information on alkali reactivity, the effect of using saturated aggregates, influence of pore spaces, and effect of thermal changes.

A refinement of the methods for determining the elastic properties of concrete by dynamic methods employing high-frequency vibration is being made. A new field of investigation is that of mineralogical characteristics of aggregate as related to concrete and the deleterious effects on concrete of certain minerals in aggregates is one of the studies being pursued.

Group III on Specifications and Test Methods has completed an extensive program of standardization resulting in five new tentative methods of test in addition to revisions of several other standards. The immediate objectives now include the refinement of the Tentative Method of Test for Soundness of Aggregate (C 88 T) to strengthen its value as a guide for use in evaluating aggregates in portland-cement concrete, special attention to the subject of methods of curing concrete, and the refinement in the Standard Method of Test for Volume Change in Cement Mortar in Concrete (C 157) to restrict the method to volume change resulting from dry shrinkage. New standards will be studied for manufactured lightweight aggregate, air-entraining and non-air-entraining admixtures for concrete, method of test for effect of air-entraining admixtures on sulfite resistance of concrete, methods of tests for non-air-entraining admixtures for concrete and method of test for lignite and coal in fine aggregate.

C-12 Unit Masonry

Subjects under consideration by Committee C-12 on Mortars for Unit Masonry include a continuation of research on pointing mortars. Close corroboration has been noted with the die penetration test work carried out at Princeton University. It is proposed to give some study to fly ash as an admixture for mortar. Work is continuing on tests for efflorescence.

C-14 Glass

The membership of Committee C-14 on Glass and Glass Products is being circulated for projects needing attention in the determination of chemical properties and analysis. A proposed test for determining the abrasive properties of glass will be studied in connection with specifications for flat glass.

C-15 Manufactured Masonry Units

An extensive review is being made by Committee C-15 of existing specifications on concrete and sand-lime units with definite revisions contemplated. A study of the specifications for glazed tile is related to the effect of size variation on modular masonry. Considerable progress has been made in drafting a specification for chemical-resistant units. As a result of the transfer of jurisdiction to Committee C-15 of standards on drain tile, a new subcommittee has been formed which is now reviewing the standard specification for this product.

C-16 Thermal Insulating Materials

The reorganization of Committee C-16 has grouped its activities into two categories, namely, thermal and nonthermal properties. Both groups are stressing methods of tests. A general procedure has been adopted for the inclusion of a significance of test statement in each existing as well as contemplated standard under the jurisdiction of the committee. Proposed tests for evaluating insulation board are being considered. The properties of plasticity, adhesion, and cohesion as they apply to insulating cements is under study.

Fire resistance tests for organic materials used for blanket insulation, a method of determining the densities of loose fill insulation, and a method of test for thermal *K* factor of pipe insulation are under consideration. Special thermal properties such as specific heat determinations, emissivity and effects of temperature, and means of determining surface coefficients for heat loss curves are being worked on. The work is being continued on determination of field clearances between pipe and insulation.

C-17 Asbestos Cement Products

Following completion of four tentative specifications covering asbestos-cement roofing, siding, flat sheets, and corrugated sheets, the current activity of Committee C-17 will be focused on a specification for asbestos-cement pressure pipe. A method of test for use in connection with this specification has already been approved. It is the intention of the committee to include statements on significance of tests in all standards under its jurisdiction and consideration will be given to this during the year.

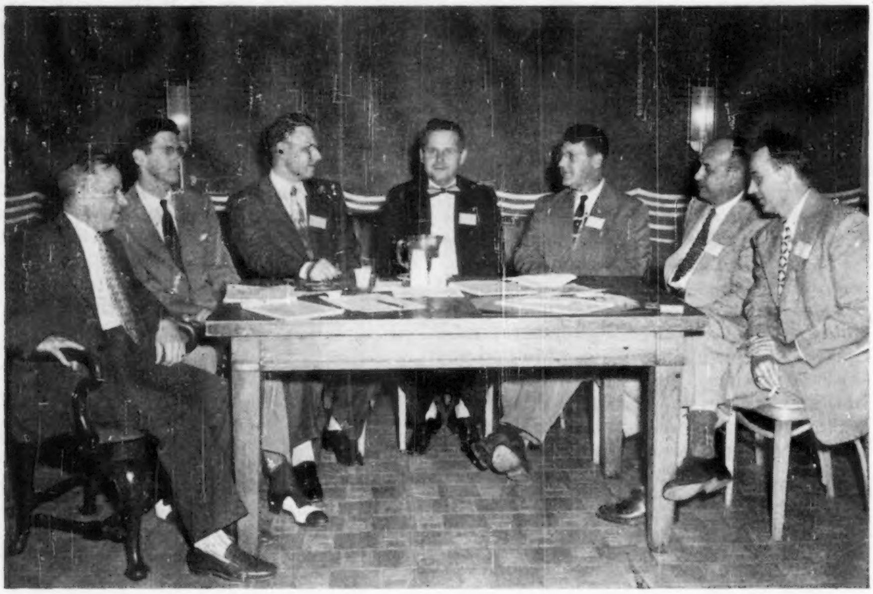
C-19 Structural Sandwich Constructions

The organization structure of Committee C-19 on Structural Sandwich Constructions has been in terms of studying

the mechanical properties of basic materials, the mechanical properties of the basic sandwich construction, and performance standards. Initially the Subcommittee on Basic Materials is studying test methods for use on core materials to measure mechanical, physical, and electrical properties. The Subcommittee on Basic Sandwich Construction is now reviewing various physical test methods including tension, compression, shear, and flexure for the purpose of adapting these in so far as possible to sandwich construction. In the study of performance standards as required for measuring permanence, durability, and simulated service, the respective subcommittee has divided the field into several categories. These cover building construction, transportation, furniture, packaging, and miscellaneous. The committee plans to utilize existing exposure facilities, which may include those now coming under the jurisdiction of A.S.T.M. through the corrosion program. Attention will also be given to a development of a fire resistance test on a completed construction or sandwich panel.

Acoustical Materials; Ceramic Whitewares; Porcelain Enamel

Items have appeared in recent BULLETINS announcing the organization of Committees C-20 on Acoustical Materials and C-21 on Ceramic Whitewares, and in this issue C-22 on Porcelain Enamel is covered.



Meeting of the Executive Committee of the New A.S.T.M. Committee C-21 on Ceramic Whitewares. From l. to r.; R. F. Geller, Ralston, Russell Jr., W. C. Mohr, John Koenig, Chairman of Committee, C. G. Harman, J. W. Hepplewhite, H. L. Stout.

"D" Committees

D-4 Road and Paving Materials

Research and developmental work covering several methods for determining asphalt content of fluid asphaltic products is under way in Committee D-4 on Road and Paving Materials, including vacuum or steam distillation and a modification of the Abson recovery procedure. It is expected to extend the present cooperative study of vertical pull ductility tests. The mechanical stirring of the heating bath as used in the two A.S.T.M. methods for determining softening point (D 36 and E 28 T) is receiving additional attention. Development of a proposed method of test for Engler specific viscosity which will be applicable to fluid tar products has reached the draft stage. A proposed method of testing paving mixtures to determine the content of bitumen by centrifugal extraction is being drafted following considerable cooperative testing.

Further cooperative tests are planned in the study of a proposed method for the setting and curing properties of bituminous road materials. The committee is continuing its study of stripping resistance of bituminous coated aggregates, and the possible application of a test using smooth glass plates for determining the relative adhesive properties of bituminous materials.

The committee proposes to study distillation procedures for asphaltic cut-back products containing additives or which give abnormal test results as a result of heating in the distillation test. A continuation of work on abrasion test for sand and further development of quality tests for coarse and fine aggregates is expected, as well as specific gravity determinations of both fine and coarse aggregates with special attention to absorptive materials.

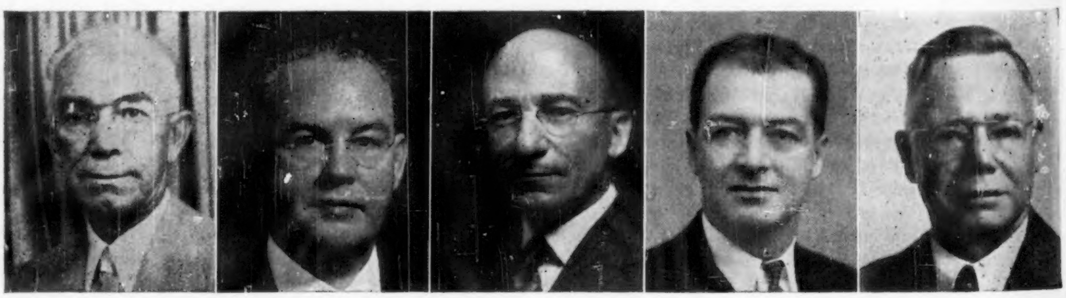
A subcommittee will endeavor to improve the method on loss on heating including modification of apparatus and procedure, and another group will continue the development of tests for the effect of water on bituminous paving mixtures especially to study the reproducibility of the recently proposed tentative method. An extensive program is in progress on laboratory methods to evaluate bituminous binders and aggregates with respect to adhesion and permanence of bituminous coatings.

A subcommittee of the group on specifications is giving further consideration to a specification for high viscosity emulsified asphalt. The preparation of specifications is under consideration for aggregates to be used in single and multiple surface treatments.

D-5 Coal and Coke

Definitions are to be prepared by Committee D-5 regarding the different forms of moisture in coal. Coal, as mined, con-

Committee D-4 on Road and Paving Materials: *l. to r.;* F. H. Baumann, Chairman; C. E. Proudley, First Vice-Chairman; A. T. Goldbeck, Second Vice-Chairman; E. W. Klinger, Third Vice-Chairman; B. A. Anderton, Secretary.



tains varying amounts of inherent or internal moisture, the amount depending mainly on the rank of the coal. In addition to this inherent moisture, coal may have considerable free or surface moisture resulting from coal washing processes or from exposure to the elements. There is a need of standardized definitions of these different forms of moisture and also of laboratory methods for their determination. After suitable definitions of different forms of moisture are agreed upon, methods of test will be investigated.

Active work is in progress in revising the present standard procedures in Methods 271 for determination of carbon, hydrogen, and nitrogen in coal. Cooperative work is in progress at various laboratories to obtain data for revisions of the present methods to take advantage of equipment and chemicals now available on the market. A laboratory method for determination of carbon dioxide existing as mineral carbonates in coal is in progress of standardization.

Considerable progress has been made on the problem of sampling and fineness tests of powdered coal collected from fuel lines of powdered coal furnaces, but more data need be assembled before the committee can prepare a revision of the present Standard Method of Sampling and Fineness Test of Powdered Coal (D 197 – 30).

A new investigation to be made is a review of procedures being used by large coal consumers at boiler plants and coke plants in the sampling of coal by automatic methods. It is hoped that this information will lead to the formulation of fundamental principles to be observed in the automatic sampling of coal and the automatic reduction of samples to convenient quantity for the laboratory.

For some years past, Committee D-5 has had under consideration the preparation of a publication on the significance of tests of coal and coke in relation to uses for combustion, carbonization, complete gasification, and liquefaction. A Symposium on Significance of Tests of Coal was held in 1937 and the ensuing publication was widely distributed. Considerable information has been assembled in regard to significance of tests in relation to combustion, and plans are under consideration for assembling this information for publication.

Cooperative testing among different laboratories is in progress with a view of standardizing the Geiseler Plastometer method for determination of plastic properties of coal when heated in connection with evaluating coals for coke making. Standard samples of pitches are being used to determine the reproducibility of the method by different laboratories.

The chairman of Committee D-5, W. A. Selvig, of the U. S. Bureau of Mines, Pittsburgh, Pa., attended the International Conference on Coal Classification in Geneva, Switzerland, held earlier this year. At the June meeting of the committee Mr. Selvig presented a brief account of the conference. Overseas thinking on classification tends more toward plastic and swelling properties—perhaps because of the more acute need for good coking coals. He reported that standardization work in this country is much further advanced than in most of the European countries, with England as a conspicuous exception.

D-6 Paper and Paper Products

In the field of test methods, study is being given by Committee D-6 to means of determining erasability, chlorides, sulfates, gloss, lint, pinholes, and expansivity of paper. In addition, revisions of methods for basis weight, pH, and organic nitrogen in paper are also nearing completion. Final revisions are being made to proposed specifications on analytical filter papers. New methods are being investigated for measuring static bending, flat crush, ring crush, tensile strength, bursting strength, and sampling of container board.

D-7 Wood

Further study will be given by Committee D-7 on Wood to a proposed method of test for determining the integrity of glued joints in laminated structural members for exterior service. This method involves cyclic treatments consisting, while immersed in water, of a 2-hr. vacuum, a 2-hr. air pressure, both after repetition to be followed by drying in air for 88 hr.

Using the methods of conducting static tests of wood poles recommended at the Annual Meeting a comprehensive test program is being considered to provide test data intercomparing the two methods and the correlation of these results with fiber stress determinations obtained by laboratory machine testing of small clear specimens cut from the same poles. The first phase of this testing will apply to a single species of untreated timber. Further phases of testing will extend to several species of untreated poles and to the same species creosoted. An allied project for working out tentative methods for testing the strength of cross arms is being organized.

The Subcommittee on Fire-Retardant Wood has discussed the need for and problems connected with a cooperative testing program on lumber treated with fire-retardant solutions to at least three retentions and three minimum penetrations. It is believed that such a program carried on by an independent committee such as D-7 will yield results that will be of great assistance in the formulation of workable specifications. Further development of this proposed work is anticipated.

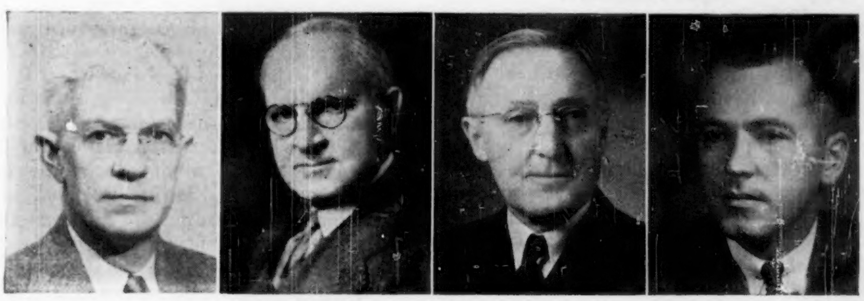
D-8 Waterproofing and Roofing Materials

All appropriate standards are being reviewed by Committee D-8 with the purpose of removing minimum requirements on mineral stabilizers in order to permit the use of unfilled coatings. Under consideration are the use of aluminum and other alloy roofing and siding nails, a specification for insulation siding, and a specification for saturated burlap as a membrane. A study is being made of various instruments used to determine the consistency of bituminous cutback coatings for cold application with the view of selecting for a test method. Also under study is the applicability of the present ductility test to roofing and waterproofing asphalts.

Various aspects of the accelerated weathering test apparatus such as the mechanics of the weatherometer itself, preparation of panels, physical and chemical changes, methods of determining the failure end point and the effect of the purity of water used in the rain cycle are being studied. Specifications and test methods for bituminous emulsions suitable for application on built-up roofing are in preparation, with close coordination being effected with existing methods as prepared by Committee D-4. Methods of evaluating adhesion of granules, both in the dry and wet state, to asphalt coatings are being developed, as well as specifications for fine dusting materials.

D-14 Adhesives

The present program of work under way in Committee D-14 is quite varied. Under strength tests, proposed methods to determine the shear strength of assemblies made with plastic adherents and adhesives are being analyzed and the behavior of adhesives in assemblies subjected to bending or flexural stresses are being evaluated in round-robin testing programs.



Committee C-12 on Mortars for Unit Masonry: (See page 25) l. to r.; J. W. Whittemore, First Vice-Chairman; T. I. Coe, Chairman; H. D. Baylor, Second Vice-Chairman; J. A. Lee, Secretary.

Peel tests with adhesive assemblies are being investigated. Techniques in which the peel of the flexible member is at 90 deg. and 180 deg., respectively, from the rigid member are being considered. A new section to write methods for creep and flow is being organized.

Work on analytical test methods to determine the solids content of adhesives is under way with five methods currently under consideration. Cyclic and continuous exposure tests to determine the effects of moisture and temperature on the permanence of adhesives are being investigated. A procedure for the continuous exposure tests is nearly ready for letter ballot. Round-robin tests to determine the effects of light on the permanence of adhesives are under way. One of the unusual and very interesting phases of the work of this group is concerned with the effect of biological environments on the permanence of adhesives. Several procedures are currently being investigated. Deterioration of adhesives as a result of exposure to bacteria, molds, rodents, and vermin such as roaches are included.

In the study of working properties, apparatus to measure tack is being developed, as well as a tentative procedure to determine storage life. It has been found that one method will not be satisfactory to measure the consistency of all adhesives. Consequently several methods are being investigated, one of these, a free-flowing cup method, being ready for adoption. Procedures for determining rate of strength development and critical glue layer thickness are being developed. Round-robin tests on applied weight per unit area of adhesives are being arranged. Sections to write specifications for a general purpose adhesive and an adhesive for acoustical tile are being organized, and also one to cover a specification for adhesives for binding books. A special invitation is advanced to book manufacturers and those interested in the use of adhesives in book binding to join in this work. This work will be a cooperative effort with the Book Manufacturers' Institute, Inc.

The perennial topic "What is adhesion?" is always under consideration by this group. In addition, methods of getting true shear forces, corrosion resistance, and permanence problems are being studied.

Committee D-14 on Adhesives: l. to r.; F. W. Reinhart, Chairman; L. P. Hart, Jr., Vice-Chairman; G. W. Koehn, Secretary: J. H. Wills, Membership Secretary.

D-15 Engine Antifreezes

Committee D-15 on Engine Antifreezes and its subcommittees have held two meetings during the year and work on the assigned projects is proceeding actively. The subcommittee on freezing point determination has completed a cooperative test program to evaluate three proposed methods for determining the freezing point of antifreeze solutions. This group plans to evaluate other suggested modifications, but will also assemble the data accumulated to date and submit it to the Society for publication as information only.

Another subcommittee has completed the preparation of a proposed specification for a hydrometer-thermometer antifreeze field tester. This specification is now out to letter ballot in the committee, with the recommendation that it be published as information. Publication as tentative must be delayed until the method for determining freezing point has been completed.

The subcommittee on physical properties has appointed subgroups to study methods for determining distillation and specific gravity of antifreezes. Both groups have undertaken cooperative test programs and have prepared test methods for approval by this subcommittee. Further work is in progress to determine the boiling point of mixed antifreezes and the specific gravity of aqueous antifreeze solutions. The proposed methods will be modified, if necessary, to include these broader scopes.

The subcommittee on chemical properties is conducting a series of cooperative tests on the following chemical properties of antifreezes and their aqueous solutions: pH and reserve alkalinity, water content, and ash and solids on evaporation. Work on the classification of antifreezes, assigned to the subcommittee for study has been postponed pending the development of necessary test methods currently under investigation by other subcommittees.

The subcommittee on simulated and actual service testing has assigned study groups to investigate procedures for corrosion and foaming designed for a more complete evaluation of antifreezes to be submitted as tentative methods. In addition, a short article on recommended cooling system practices is being prepared for publication.

Special consideration is being given to the preparation of a circulating corrosion test method based on the procedure used by the National Bureau of Standards for use by the Ordnance Department.

A new subcommittee on specifications was organized to consider important properties for which test methods should be developed by the other subcommittees. This subcommittee has recommended that immediate consideration be given to the following properties:

Freezing point
Boiling point
Field testing
pH and reserve alkalinity
Corrosion
Foaming
Storage stability
Solids on evaporation.

Other properties were considered but recommendations to the committee were temporarily withheld for the following reasons: it was felt that difficulty would be encountered in preparing suitable test methods for heat transfer, seepage, and flammability in the foreseeable future; viscosity and effect on car finish were believed to be irrelevant to the problem under consideration; and it was felt that toxicity was beyond the scope of A.S.T.M. and was more properly the concern of qualified health organizations.

A special study group has been appointed under the leadership of R. E. Mallonee to formulate standard conditions for sampling and testing antifreeze materials in order that test data on the properties of antifreezes may be more readily correlated.

Committee D-15 plans to hold its next meeting in New York City at the Hotel Statler on September 22 and 23, to review the progress made on the several assigned projects and cooperative test programs.

D-17 Naval Stores

The program of work for Committee D-17 on Naval Stores will include additional collaborative testing on the new tentative method for unsaponifiable matter in rosin (D 1065 - 49 T). The work of several committee members has indicated that the usual method for unsaponifiable matter was not satisfactory for rosin because in that case the unsaponifiables consist partly of volatile oils which may be lost in the usual separatory funnel method. The new tentative, the initial work on which was published by one of the committee members some ten years ago, is not yet giving good enough agreement between the collaborating laboratories, and modifications are planned which, it is hoped, will give better agreement.

Additional work is to be done on the Tentative Methods for Volatile Oil in Rosin (D 889 - 46 T), and Water in Liquid Naval Stores (D 890 - 46 T). A modification of the method of preparing and using the Karl Fischer reagent in the latter method appears to be helpful by making the test solutions more stable prior to their

use and, therefore, should give more reliable results.

Additional work is also to be done on the Tentative Methods of Testing Tall Oil (D 803 - 44 T). Known mixtures of pure fatty acids and rosin acids will be prepared and distributed for collaborative test in an effort to establish more suitable equations for computing the rosin acid content of tall oil. Finally, the newly suggested methods for testing rosin oil, published as information in the 1949 Report of Committee D-17, will be submitted to producers and consumers of this type of material in order to obtain suggestions by which the methods can be improved for adoption as tentative at the 1950 annual meeting.

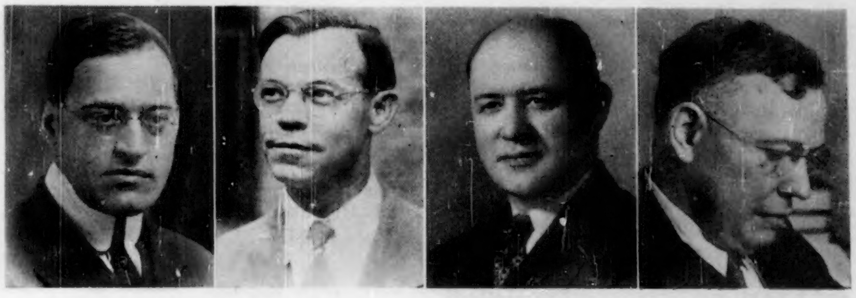
D-19 Industrial Water

In Committee D-19, the Editorial Subcommittee continues its work on the Manual on Industrial Water, while the Subcommittee on Sampling is studying improvements in the Method for Sampling Boiler Water (D 860). Work also continues on methods for sampling water at sub-atmospheric pressures with four applicable procedures being studied.

The Subcommittee on Analysis is undertaking three new projects: the development of methods for (1) color and turbidity, (2) heavy metals, and (3) fluoride ion. The Section on Electrometric Methods has drafted a Proposed Method for Determination of Electrical Conductance, while the Section on Special Methods has made considerable progress in revising a recommended practice on X-ray diffraction examination for publication as tentative. Progress has also been made on a method for detection of algae. The subsection on spectroscopy promises a spectrographic procedure in the near future and a method for polarized microscopy is being studied. The Section on Analysis of Water-Formed Deposits has completed the first draft of a comprehensive analytical scheme for their analyses.

The Subcommittee on Classification has been assigned the preparation of a specification for high purity water which could be used both for general laboratory service and for process work. The Subcommittee on Methods of Testing continues its study of a specification for substitute ocean water, while its Subsection on Service Testing of Pipe and Tube has made an extensive survey of background information as a first step in the development of a standard.

The Subcommittee on Water-Borne Industrial Wastes has its four sections organized for active work during the coming year. The Section on Critical Constituents is studying these from the standpoint of those that would be produced by specific industries. The Section on Methods of Analysis is initiating its program on approximately 10 constituents common to most industrial wastes, such as acidity or alkalinity, pH, suspended solids, turbidity, etc. The Section on Sampling and Gaging will develop methods for sampling and



Committee D-19 on Industrial Water: l. to r.: M. Hecht, Chairman; F. R. Owens, Vice-Chairman; L. K. Herndon, Vice-Chairman; R. E. Hall, Secretary.

gaging and for the preservation of samples. Also undertaken is the preparation of a standard method for reporting the analysis of industrial waste in which will be included the complete history concerning the sample with operating conditions in the plant, and the establishment of a uniform manner of reporting the results of the completed analysis.

The interest of industry in the work on industrial wastes of D-19 is evidenced by the continued receipt of applications for membership on the subcommittee, the full attendance at its meetings, and the large attendance and spirited comment at the Round-Table Discussion on Standards for Water-Borne Waste which was presented during the Annual Meeting.

Additional statements on the standardization activities of other committees in the "D" group may appear in the October BULLETIN. *Many of the projects in this field were also covered in the Committee Notes published in the July* BULLETIN.

"E" Committees

E-2 Spectrographic Analysis

Many new types of apparatus and methods for spectroscopic analysis by emission techniques have been developed in recent years. Variations in currently used methods accordingly have been so great as to preclude, for the time being, the development of new tentative methods by Committee E-2. The committee has undertaken the collection of a group of suggested methods that will represent the methods which are currently being used with the satisfactory results. Publication of these methods for review and use is expected to provide the means of evaluating the various kinds of apparatus and techniques now being used and thereby to provide the initial step toward the development of tentative methods for spectroscopic analysis by emission techniques. Committee E-2 expects to have about twenty suggested methods ready for publication early next year.

E-4 Metallography

A new subcommittee concerned with the electron microstructure of steel has been organized in Committee E-4, which consists of a group of electron microscopists and metallurgists representing a number of organizations interested in steel. This group has been working on a standardized procedure for using the electron microscope and will soon be in a position to present this to the Society.

There are several recommended practices which are well advanced in committee work. These include Practices for Determining the Orientation of Metal Crystals, for the Determination of Pole Figures, and for Classification of Ferrite Grain Size in Steels. A revision of Tentative Method E 2 presented to the Society at the annual meeting omits the nonferrous grain size standards formerly in this document. The committee has agreed upon a new grain size standard for nonferrous metals and alloys which should be published soon. Also in its final stages is a recommended practice for dilatometric analysis.

Subcommittee VI on X-ray Methods of Committee E-4 which works in cooperation with the Joint Committee on X-ray Diffraction of the A.S.T.M., A.S.X.-R.E.D., and the British Institute of Physics announced that the new edition of the card index file for identification of crystalline materials is being made ready for press. It is expected that the new edition, which consists of approximately 4000 cards, will be printed on the regular 3 by 5-in. cards but consideration is being given to supplying also 4 by 6-in. cards which will permit mechanical sorting.

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E-5 Fire Tests

The program of standardization activities of Committee E-5 on Fire Tests of Materials and Construction includes further study of revisions in Methods of Fire Tests of Building Construction and Materials (E 119–47) which will possibly include the elimination of change in heat transmission as a criterion for testing protected steel beams and girders in an unloaded condition. Revision of door dimensions and hose stream requirements in Methods of Fire Tests of Door Assemblies (E 152–41) will be taken under advisement. Under development are new standards for fire tests of acoustical and similar finishes and of roof coverings. The need for standards for impact test of partitions prior to fire test and a noncombustible test for building materials will be considered. The possibilities of an organized investigation will be discussed to produce data on severity of fires involving various types of building occupancies and the establishment of fire conditions producing a hazard to human life.

Committee E-5 on Fire Tests of Materials and Construction: l. to r.: A. L. Brown, Chairman; W. J. Krefeld, Vice-Chairman; H. M. Robinson, Secretary.

E-6 Building Constructions

Suggested revisions are being reviewed by Committee E-6 on Methods of Testing Building Constructions in the present Tentative Methods of Conducting Strength Tests of Panels for Building Construction (E 72). The possibility of a test procedure for the connections between foundation and wall or between wall and roof is being considered. Information will be obtained on a comparison of model testing *versus* prototype and full-size member testing on connections and assembled structures. Information is being collected on whether the general methods set forth in the Tentative Methods of Testing Truss Assemblies (E 73 T) for rapid proof and acceptance testing are satisfactory or whether more refined methods for laboratory testing are desirable.

A revised draft of proposed methods of test for strength and stiffness of prefabricated floor and roof constructions for buildings is being reviewed. The need is felt for a convenient field method for ascertaining the thermal performance of constructions and the suitability of a small heat flow meter is being investigated for its adaptability to this purpose. A test method for laboratory measurements of air-borne sound transmission loss of building floors and walls is in final draft form and is now being reviewed. A subgroup has been organized to study the need and feasibility of developing a small-scale fire test of wall panels.

E-9 Fatigue

Committee E-9 on Fatigue, having completed the Manual on Fatigue Testing which will be printed some time this fall, is now turning its attention to other matters. A subcommittee has been constituted to compile two lists which will be of considerable interest to all workers in fatigue. The first will be a list of current fatigue projects so that laboratories can be informed as to where other work similar to theirs is being done and so help in coordination and avoid duplication. The second will be a list of subjects upon which information is needed so that those laboratories which have facilities can select an appropriate subject for study.

Porcelain Enamel Committee Organizes

THE ever-widening use of porcelain enamel products, probably one of the latest being in the housing field, has amplified the need for research and development of standards for measuring the quality of porcelain enamel and porcelain enamel products. The varied interests in this field have recognized the particularly advantageous position that A.S.T.M. can play in such developmental work, in recommending the formation of a new technical committee.

Committee C-22 on Porcelain Enamel held its organization meeting on June 17, 1949, at Society Headquarters. A very representative group was in attendance including producers of frits and other raw materials, producers of porcelain enamel products, as well as many consumer interests and research organizations. Previous to this organization meeting a considerable amount of study was given to the need for A.S.T.M. participation in this field. Following an extensive survey by correspondence conducted under the auspices of the Administrative Committee on Standards a conference was held which disclosed a definite opinion that the organization of an A.S.T.M. technical committee in this field would be highly desirable. A motion was passed recommending that this action be taken by the Board of Directors.

The scope of the new committee as accepted at this meeting is:

> The formulation of definitions of terms, test methods and specifications pertaining to those materials generally considered to be in the field of commercial porcelain enamel products. Ceramic and ceramic-metal coatings for metal are included.

It is the intention that this scope will cover all commercial porcelain enamel including high-temperature coatings. It was the consensus that the initial efforts of the committee should be given to the development of test methods covering three phases, namely, raw materials, materials in process, and finished products. A subcommittee was authorized on this basis. The need for definitions was expressed and a subcommittee authorized.

It is expected that the work of the new committee will be closely coordinated with that of the Porcelain Enamel Institute as well as other agencies in the porcelain enamel field. Close coordination will also be effected with the Enamel Division of the American Ceramic Society many members of which are on the new committee.

Permanent officers were elected as noted below. The chairman was authorized to appoint an Executive Subcommittee whose chief function initially will be that of completing the organization of the committee.

The personnel of Committee C-22 follows.

A.S.T.M. Committee C-22 on Porcelain Enamel

CHAIRMAN: W. N. HARRISON, National Bureau of Standards, Washington 25, D. C.

VICE-CHAIRMAN: D. G. BENNETT, Department of Ceramic Engineering, University of Illinois, Urbana, Ill.

SECRETARY: G. H. SPENCER-STRONG, Pemco Corp., 5601 Eastern Ave., Baltimore 24, Md.

Producers

Armco Steel Corp.	J. J. Canfield
Briggs Mfg. Co.	S. E. Hemsteger
Campbell, G. E. (Borg-Warner Co.)	
Chicago Vitreous Enameled Products Co.	E. P. Bolin
Dexheimer, E. C. (Nat. Enameling and Stamping Co.)	
Ferro Enamel Corp.	G. H. McIntyre B. J. Sweo Michael Bozsin

(Over)

General Electric Co., Erie Works	J. A. Schiefferle
General Electric Co., River Works	Wm. Irby
Hommel Co., O., The	J. F. Matejczyk
Hotpoint, Inc.	G. E. Terry
Howe E. E. (Lustron Corp.)	
Inland Steel Co.	F. R. Porter
Inst. of Cooking and Heating Appliances	Sam Dunckel
Pemco Corp.	G. H. Spencer-Strong J. B. Willis
Peterson, F. A. (Univ. of Ill.) (Repr. Enameled Utensil Mfrs. Council)	
Porcelain Enamel Institute	E. Mackasek
Roper Corp., G. D.	E. H. Shands
Scripture, C. P. (Ingram-Richardson Mfg. Co.)	
Smith Corp., A. O.	W. A. Deringer
Universal-Rundle Corp.	J. R. Beam W. T. Dyre
Westinghouse Electric Corp.	R. F. Bisbee

Consumers

Goodyear Tire and Rubber Co.	D. R. Fritsch
Housing and Home Finance Agency	R. Skagerberg
Sears, Roebuck and Co.	J. N. Gregory
Tesi, A. F. (W. T. Grant and Co.) (Repr. Natl. Retail Dry Goods Assn.)	
U. S. Dept. of Navy, Bureau of Ships, Code 350	J. H. Chilcote

General Interests

American Ceramic Society	J. C. Richmond
Armour Research Foundation	E. P. Flint
Battelle Memorial Institute	L. S. O'Bannon
Bennett, D. G. (Univ. of Ill.)	
Cook, R. L. (Univ. of Ill.)	
Harrison, W. N. (National Bureau of Standards)	
Judd, D. B. (National Bureau of Standards)	
New York State College of Ceramics	V. D. Frechette
North Carolina State College	M. A. Tuttle
Rutgers University	J. H. Koenig
U. S. Bureau of Federal Supply	B. Siegel

Committee D-12 on Soaps and Other Detergents: l. to r.: F. W. Smither, Chairman; F. Krassner, Vice-Chairman; J. C. Harris, Secretary.

Committee E-11 on Quality Control of Materials: l. to r.: H. F. Dodge, Chairman; A. E. R. Westman, Vice-Chairman; O. P. Beckwith, Secretary.

Committee E-7 on Non - Destructive Testing: l. to r.: J. H. Bly, Chairman; H. C. Amtsberg, Vice-Chairman; D. T. O'Connor, Secretary.

Committee D-18 on Soils for Engineering Purposes: l. to r.; E. J. Kilcawley, Chairman; W. S. Housel, First Vice-Chairman; F. J. Converse, Second Vice-Chairman; R. F. Blanks, Secretary; W. G. Holtz, Assistant Secretary.

Program for Testing Wood Poles to Determine Allowable Fiber Stresses

Important Work Under Way in A.S.T.M. Committee.

By L. G. Smith[1]

As the long-existing need for more definitive data on the strength of poles has become of greater economic importance, Subcommittee VII of A.S.-T.M. Committee D-7 on Wood has considered techniques of testing and a program of testing wood poles to gather sufficient data to determine the proper allowable fiber stresses. In the 1920's, a sectional committee under the American Standards Association developed a uniform classification for wood poles which culminated in standards for western red cedar, southern yellow pine, chestnut, and northwestern cedar poles. The allowable fiber stresses were based upon tests of full-sized poles then available. Later lodge pole pine and ponderosa pine poles were added to the American Standards. Since test data on full-sized poles of these latter two species were not available in sufficient quantity at that time, the allowable fiber stresses for these two species were based largely on tests of small clear green specimens. The ratio chosen of allowable fiber stress to the modulus of rupture to small clear green specimens was 1.18. This was a higher ratio than used for the species considered in the initial step. During World War II, the general shortage of pole material resulted in the consideration of various miscellaneous conifers. The emergency war standards developed and published at the end of the war for these new species permitted fiber stresses of some species having ratios as high as 1.5.

Inconsistencies and Lack of Data

When the new American Standards were adopted in 1948, the inconsistencies in the method of rating the various species of poles were recognized in that the older species were more conservatively rated than the newer species. However, it was also recognized that the test data on full-sized pole specimens were inconclusive. This is apparent when it is considered that tests on poles of one species showed the fiber stresses at rupture varying from 4000 to over 9000 psi. Since the species in the old standards were included in the National Electrical Safety Code and as some 38 states had adopted the NESC (in some cases after many years of urging) it was decided to leave them in the standards at the old values and include the newer species at allowable fiber stresses about 18 per cent higher than the modulus of rupture of small clear green specimens. At the time of the adoption of the now current American Standards for wood poles, the possible re-rating of all poles was left for future consideration.

Because of the dearth of data on actual strength of wood poles and crossarms as developed by tests and due to the absence of any accepted test procedures that would give reproducible results which could be correlated with other data, A.S.T.M. Committee D-7 organized Subcommittee VII to consider procedures and programs for testing wood poles and crossarms. Since its organization, the subcommittee has prepared a tentative specification for methods of conducting static tests of wood poles. The subcommittee then drafted a proposed program for testing poles with the object of more accurately determining consistent values for fiber stresses at rupture of full-sized poles and their correlation with the moduli of rupture of small clear specimens.

Basic Problem

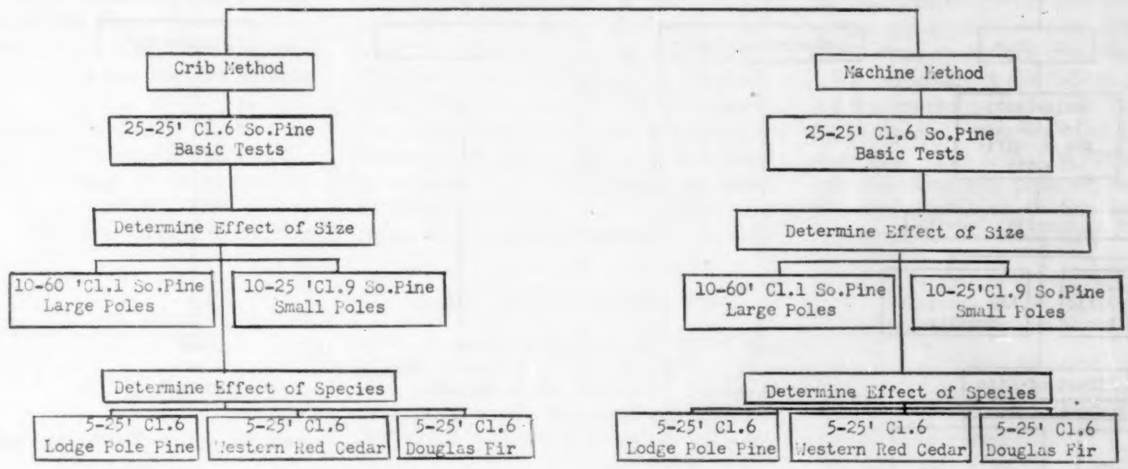
Basically, the problem, which faces the pole using industry and which is being considered by the subcommittee, is the fundamental fact that the less we know about a material the greater the factor of safety that must be used in its application. It is generally conceded that the present allowable fiber stresses of the species of poles now in use are not on an equitable basis. Some of the older species of poles are more conservatively rated than the species more recently introduced for utilization as poles. The early National Electrical Safety Codes rated the older species very low due to lack of adequate test data and operating experience. For instance, the second edition of the NESC in 1916 allowed a maximum fiber stress of 5000 psi. for chestnut, western red cedar, and western pine poles. As further experience was secured and more test data were obtained and analyzed the allowable fiber stresses were raised selectively by species. Consequently, the older species, whose ratings are the outgrowth of an ultraconservative origin, are penalized in comparison with the newer species, which have been introduced with relatively few test data or operating experience being available. Conversely, further experience may indicate that the newer species are overrated. As there is every indication that the timber supply will become less plentiful, it is obvious that unnecessary factors of safety will become progressively more expensive. As an example of what this may mean to the pole purchasing industry, if the allowable fiber stress were increased by 25 per cent, the circumference of the poles could be decreased by 8 per cent. In the case of pine poles alone, based upon 1947 consumption figures, such an increase in allowable fiber stress would represent a saving of the order of $18,000,000 per year. Another illustration is if, by the elimination of unnecessary factors of safety, we could save on an average $1 a pole, the over-all saving to the industry would be of the order of $8,000,000 per year. Obviously, a more accurate evaluation of the strength of the poles would constitute a distinct economical gain to the industry.

Round-Table Discussion Outlines Program

After formulating a suggested program for determining information to permit a more accurate determination of pole strength, the subcommittee sponsored a round-table discussion at the 1949 Annual Meeting of the Society, with the object of securing a wider dissemination of the program and to obtain additional ideas. Mr. Markwardt, Chairman of Committee D-7, opened the discussion by outlining the reason for the formation of Subcommittee VII. He stated that new species were being introduced to replace those in short supply and therefore there was a need for more test information on all species of poles. He emphasized the need for correlation between tests on full-sized poles and tests on small, clear specimens. Mr. Hocker, Chairman of Subcommittee VII, informed those present of the new tentative methods of conducting static tests of wood poles. Two methods of making tests were covered

[1] Superintendent, Electric Distribution Department, Consolidated Gas Electric Light and Power Company of Baltimore; Chairman of the task group in A.S.T.M. Committee D-7 on Wood.

Fig. 1.—Series 1—Tests to Correlate Two Methods of Testing (Untreated Poles).



Notes:

1. Sections will be taken from each pole tested and sent to Forest Prod. Lab. to have tests made on small clear samples. Include data on moisture content of pole at point of break.

2. Poles of same species should be from same site, have about same specific gravity, and about the same defect.

3. Poles will be hand shaved.

namely, the cantilever or crib method and the machine method. He outlined the need for making tests to check these procedures as well as determining fiber stresses at time of rupture.

Colonel Smith, chairman of the Task Group on the testing program, outlined the program proposed by the subcommittee for testing wood poles. The object of this program is to:

(1) Determine the adequacies of the two proposed testing methods and to establish the correlation factor between them.
(2) Insure that the methods specified may be used for any species and any type of treatment.
(3) Check the present values of maximum allowable fiber stresses.
(4) Establish a correlation between fiber stresses at time of rupture of full-sized poles and the moduli of rupture of small, clear specimens treated and untreated.

Deterrents to consistent results are introduced, first, by variables in the technique of testing and, secondly, by variables in the poles themselves. It is hoped that inconsistencies introduced by variables in the testing technique will be eliminated by the use of the new tentative methods adopted. Inconsistencies due to variables in the poles themselves will be minimized by control in selection of material and by making tests on the various species in sufficient quantity to obtain species averages. In the initial tests, defects will be controlled and in the later series an attempt will be made to correlate them. Quality will be controlled by securing poles from the same general site and by using poles of the same specific gravity with check tests made for poles of high and low specific gravity. The same size of pole, 25-ft. class 6's, will be used for the basic tests with check tests on large poles (60-ft. class 1's) and on small poles (25-ft. class 9). Moisture content will be controlled by butt soaking on poles tested. Temperature at time of test will be 70 F, with a tolerance of plus or minus 10 per cent.

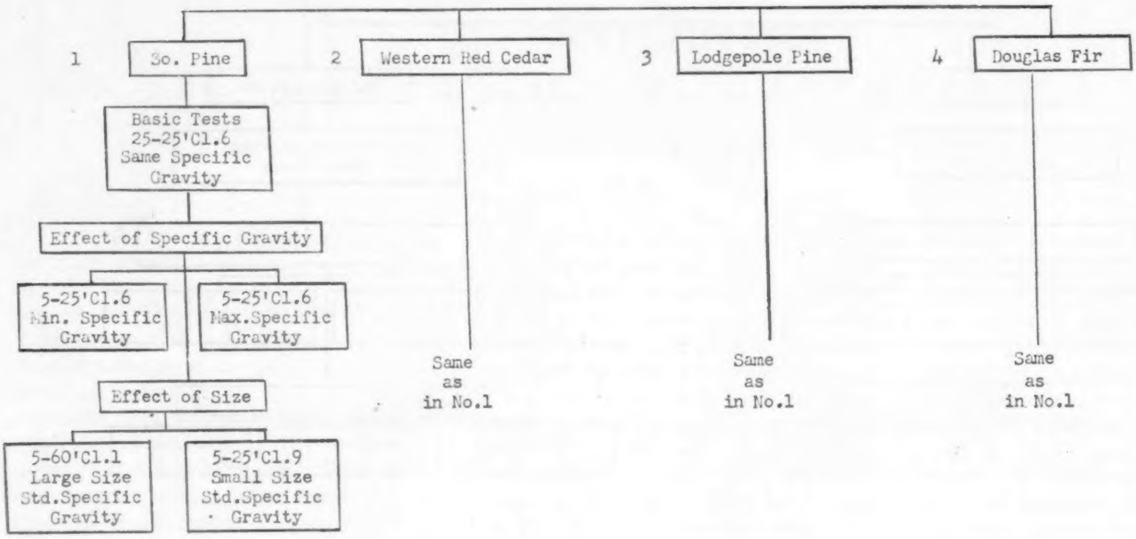
Series 1, Tests to Correlate Methods of Testing, is outlined in Fig. 1. Series 2, Tests to Develop Inherent Strength of Untreated Poles, is outlined in Fig. 2. Series 3, Tests to Develop Inherent Strength of Treated Poles, is shown in Fig. 3. All poles will be 5 ft. longer than the length of pole specified for the test to permit cutting off a section for making small clear tests. In the case of poles to be tested after treatment, poles will be 10-ft. longer so that a 5-ft. sample can be cut prior to treatment and another sample cut after treatment.

It is imperative that an experienced engineer be retained to supervise the conduct of the program. It is proposed to conduct the test at the U. S. Forest Products Laboratory. It is estimated that the cost of the entire series of tests, which will require several years to complete, will be on the order of $90,000.

Need for Program Confirmed

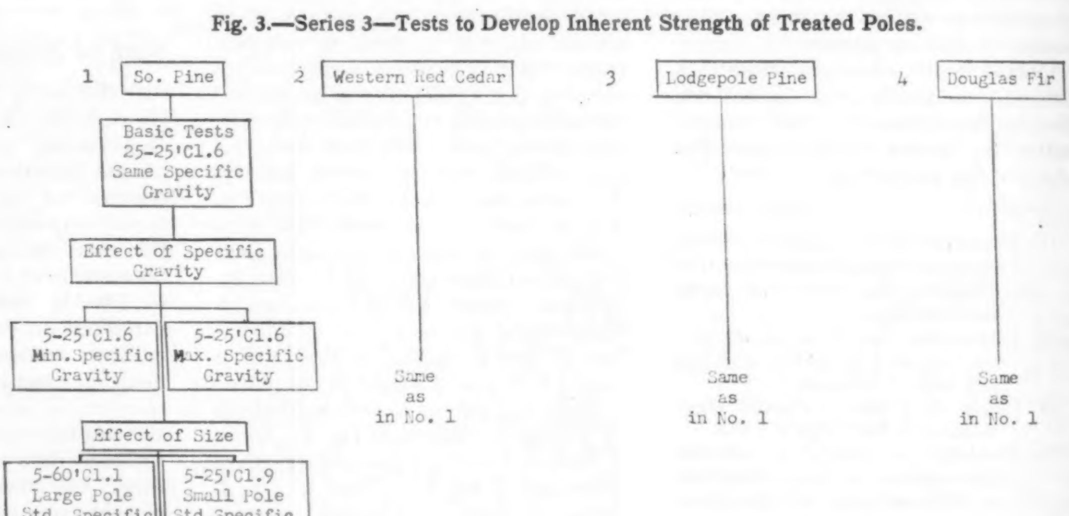
In discussing the test data secured in the past, Mr. Eggleston, Bell Telephone Laboratories, presented data showing a wide variation of the fiber stress at rupture for each species. For each species in general use at the present time, the ratio of maximum to minimum fiber stress at rupture varied from 2.4 to 5.0. It was explained that these variations were due to the differences in moisture content, in seasoning, in the method of test including the rate of application of stress, the method of calculating the modulus of rupture, and insufficient data in the tabulation of results. Comments by representatives of pole using organizations were introduced by Mr. Welier, American Telephone and Telegraph Co., who outlined the breadth of interest in this subject, in that producers, treating companies and users, as well as the general public, all were interested. He emphasized that to achieve economy consistent with safety and reliable service, we must know a great deal more about the material used than is now known. Since past test data are not reliable, additional test data, secured under controlled conditions, must be obtained. He developed the point that we must

Fig. 2.—Series 2—Tests to Develop Inherent Strength of Untreated Poles.



Notes:
1. Sections will be taken from each pole tested and sent to Forest Prod. Lab. to have tests made on small clear samples. Include data on moisture content at point of break.
2. All poles machine shaved.
3. All poles except those specified max. or min. specific gravity to be of approximately the same specific gravity.
4. Attempt to correlate effect of defects.
5. Species normally incised before treatment will be incised.
6. Use either method of testing, using correlation established in Series 1.

Fig. 3.—Series 3—Tests to Develop Inherent Strength of Treated Poles.



Notes:
1. Sections will be taken from each pole tested and sent to Forest Prod. Lab. to have tests made on small clear samples. Include data on moisture content at point of break.
2. Sections will be taken from each pole tested prior to treatment and sent to Forest Prod. Lab. to have tests made on small clear samples of untreated wood.
3. Poles of each species from same site.
4. Poles of each species to have about same specific gravity except those specified max. or min. specific gravity.
5. Poles to be machine shaved.
6. On species where incising is standard practice, poles will be incised.
7. Select poles that have about same number and type of defects.
8. Use either method of testing, using correlation established in Series 1.

know more accurately the loading conditions and their effect upon fiber stresses. Other representatives of pole users, such as the Rural Electrification Administration and the Navy Department, concurred in the need for reliable test data.

In discussing the details of the proposed program, Professor Dietz, M.I.T., emphasized the need for statistical assistance. He was advised that this is planned. Mr. Fulweiler, consulting chemist, stressed the care that must be taken in determination of moisture content due to the fact that it varies considerably throughout the pole. In reply to several questions concerning the types of treatments to be considered in the test program, it was developed that since creosote was the predominant treatment it seemed logical to use that as a basis. If the tests using creosote treatment establish a correlation between the maximum stress of a pole and the modulus of rupture of small, clear specimens, it will be possible to test various treatments as well as various species using pilot samples and testing small, clear specimens from them.

The procedure to be followed in raising the money necessary to implement the proposed program was discussed generally. The feeling of all those present was that the program was desirable and would pay profits to both the pole suppliers as well as users.

Information on Availability of Rare Chemicals

ALTHOUGH the demands for certain rare chemicals may be very few and for small quantities, the need is often urgent, sometimes even involving materials needed for saving human lives. A National Registry of Rare Chemicals is maintained at the Armour Research Foundation of Illinois Institute of Technology to act as a clearing house for information about such rare chemicals. At the end of the 1947–1948 fiscal year, the Registry listed sources of more than 13,500 rare compounds.

Ordinarily the Registry does not buy, sell, or stock any chemical, nor does it enter into financial negotiations with the supplier or purchaser. In those cases where the supplier wishes to remain anonymous, however, the Registry will act as intermediary in the negotiations, transmitting price information, the chemical, and payment for it without disclosing the identity of the supplier.

The Registry welcomes inquiries from scientists in all parts of the world whether they be in university, government, or industrial laboratories. Certainly the service of the Registry should be of value to many A.S.T.M. members.

Errata—Gambrill for Lykken

AFTER arranging for a photograph of the meeting of Division III on Elemental Analysis of Committee D-2 on Petroleum Products and Lubricants which was reproduced in the July BULLETIN, page 20, it is with chagrin that we point to an error in the caption indicating that Dr. Louis Lykken, Shell Development Co., was chairman of the division. We should have indicated that he was acting chairman, because Charles M. Gambrill, "Charlie" to most everybody, is the chairman of the division but was unable to get to Atlantic City and Dr. Lykken, the committee secretary, pinch-hit for him.

Articles on Steel Hardenability

THE *SAE Journal* is running a series of articles on Hardenability, which was prepared at the request of the SAE Iron and Steel Technical Committee. Following an introduction by Joseph Geschelin of Chilton Co., the series covers Significance of Hardness, Steel Composition Related to Hardenability, Hardenability Selection Method, Another Method of Hardenability Correlation, and Where H-Bands Do Not Apply. Copies of the 32-page, 8½ by 11 in. reprint of the series can be obtained from the SAE office, 29 West 39th St., New York, 18, N. Y., at $2.50, price to SAE members being $1.25.

Unified and American Screw Threads

THE American Standard Unified and American Screw Threads ASA B1.1-1949 has been published by The American Society of Mechanical Engineers 29 West 39th St., New York 18, N. Y., and copies of the 100-page document, page size 8½ by 11 in., can be procured from the A.S.M.E. Office at $3 each. This complete compilation issued in May, 1949, gives the latest information and data resulting from the recent international accord, and the unified threads covered in the standard are in complete accord with the new British Standards.

A.S.T.M. Specifications Help Take Oil from the Gulf of Mexico

THERE has been a great deal of interest in the drilling operations for oil being carried out by the Humble Oil and Refining Co. and others in the Gulf of Mexico. A.S.T.M. specifications have had a part in this project as in innumerable others, and all of the structural steel members and the plates for the equipment and structure shown in the attached photograph were purchased through the A.S.T.M. Specifications for Structural Steel for Bridges and Buildings, A 7. This rig is eight miles offshore from Grande Isle, La. The half-acre drilling platform accommodates the equipment and the crew of about 50 men. The total dead and live load is about 10 million pounds. The water is 48 feet deep at this point. This photograph and the information about the use of the specifications was obtained through the courtesy of the American Institute of Steel Construction and the Humble Oil and Refining Co.

New Members to August 17, 1949

The following 67 members were elected from June 28, 1949, to August 17, 1949, making the total membership 6581.

Names are arranged alphabetically—company members first, then individuals.

Chicago District

ACOUSTICAL MATERIALS ASSN., Wallace Waterfall, Secretary-Treasurer, 205 W. Monroe St., Chicago 6, Ill.
COOPMAN, WILLIAM M., City Civil Engineer, City of Moline, Illinois, Municipal Bldg., Moline, Ill.
IRVIN, HOWARD H., Chief Chemist, Marbon Corp., 1926 W. Tenth Ave., Gary, Ind.
KECK, GEORGE FRED, Architect, 612 N. Michigan Ave., Chicago 11, Ill.
LATTAN, J. E., Standards Engineer, Taylor Forge and Pipe Works, Box 485, Chicago 90, Ill.
RAY, WALTER J., Vice-President, Robert Tarrant Manufacturing Co., 323–329 W. Illinois St., Chicago 10, Ill.
REA, ROBERT F., Technical Service Manager, Zonolite Co., 135 S. La Salle St., Chicago 3, Ill.
SHIRLEY, WILLIAM C., Chief Metallurgist, U. S. Reduction Co., East Chicago, Ind. For mail: 921—174th St., Hammond, Ind.
WASHA, GEORGE W., Associate Professor of Mechanics, University of Wisconsin, Education-Engineering Bldg., Madison 6, Wis.
WISCONSIN STATE CRIME LABORATORY, C. M. Wilson, Superintendent, 917 University Ave., Madison 5, Wis.

Cleveland District

DONALDSON, GEORGE H., Vice-President and Secretary, The Machined Steel Casting Co., Alliance, Ohio.

Detroit District

MIDLAND, CITY OF, M. V. Hunter, City Engineer, Midland, Mich.
PERRINE, HAROLD, Consulting Engineer, Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, Ohio.

New England District

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS, H. W. Stiegler, Director of Research, Lowell Textile Inst., Lowell, Mass.
SCHWARZ, MAURICE, Shop Superintendent, EIS Automotive Corp., Box 701, Middletown, Conn.

New York District

ALLOY STEEL PRODUCTS CO., E. G. Holmberg, Metallurgist, 1300 W. Elizabeth Ave., Linden, N. J.
CONNECTICUT TELEPHONE AND ELECTRIC DIVISION, GREAT AMERICAN INDUSTRIES, INC., Paul T. O'Neil, Chief Engineer, Meriden, Conn.
CUSTOM SCIENTIFIC INSTRUMENTS, INC., Robert R. Allen, President, Box 170, Arlington, N. J.
KESSLER, WALTER H., CO., INC., Walter H. Kessler, President, 97 Reade St., New York 13, N. Y.
BISHOP, H. BERKEY, General Manager, Kotal Co., 360 Springfield Ave., Summit, N. J.
COLLYER, WILLIAM I., Commissioner of Public Works, Department of Public Works, City Hall, 255 Main St., White Plains, N. Y.
ELLIS, GREER, Mechanical Engineer, Ellis Associates, Box 77, Pelham 65, N. Y. For mail: 413 First Ave., Pelham 65, N. Y.
HARRIS, ALBERT VICTOR, Eastern Sales Manager, Haynes Stellite Co., 30 E. Forty-second St., New York, N. Y.
SAGER, DEWITT D., Assistant Chief, Technical Div., Materials and Testing, Picatinny Arsenal, Qtrs. 1109, Dover, N. J.

Northern California District

CALIFORNIA STATE DEPARTMENT OF PUBLIC WORKS, DIVISION OF ARCHITECTURE, C. A. Henerlong, Principal Mechanical and Electrical Engineer, Public Works Bldg., Sacramento 7, Calif.
CALIFORNIA STATE DEPARTMENT OF PUBLIC WORKS, DIVISION OF ARCHITECTURE, W. H. Petersen, Public Works Bldg., Box 1079, Sacramento, Calif.
HOWARD, E. LORENZO, Testing Engineer, Pacific Coast Aggregates, Inc., 400 Alabama St., San Francisco, Calif. For mail: 623 Manila Way, Colna 25, Calif.
INSTITUTE OF TRANSPORTATION AND TRAFFIC ENGINEERING, Harmer E. Davis, Director, University of California, Berkeley 4, Calif.
LINDGREN, CHARLES J., Owner, Tricosal Co., 461 Market St., San Francisco, Calif.

Ohio Valley District
(In Course of Organization)

HAUCK, FREDERICK A., President, Continental Mineral Processing Corp., 1413 Traction Bldg., Cincinnati 2, Ohio.

Philadelphia District

UNIVERSAL DENTAL CO., I. Wiener, Forty-eighth and Brown Sts., Philadelphia 39, Pa.
CLARKE, P. C., Assistant General Manager, Hunter Spring Co., Lansdale, Pa. For mail: Line Lexington, Pa.
DUBOIS, H. B., Vice-President in Charge of Sales, Consolidated Feldspar Corp., 1403 Trenton Trust Bldg., Trenton 8, N. J.
PAYNE, C. R., President, Electro-Chemical Supply and Engineering Co., Emmaus, Pa.
PENNSYLVANIA, COMMONWEALTH OF, DEPARTMENT OF FORESTS AND WATERS, R. J. Gillis, Director, Bureau of Waters, Education Bldg., Harrisburg, Pa.

Pittsburgh District

HOMMEL, O., CO., THE, J. F. Matejczyk, Coordinator of Research and Manufacturing, Box 475, Pittsburgh 30, Pa.
BAKER, W. E. BYRON, Manager of Paper Research, New York & Pennsylvania Co., Inc., Lock Haven, Pa. For mail: 263 N. Fairview St., Lock Haven, Pa.
FLANDERS, ALBERT C., Plant Metallurgist, Wheeling Steel Corp., Benwood Works, Benwood, W. Va.
KEELEY, ARMAND E., President and Chief Engineer, Prismo Safety Corp., 301 Penn St., Huntingdon, Pa. For mail: Taylor Highlands, Huntingdon, Pa.
KENDALL, V. V., Corrosion Engineer, National Tube Co., Box 266, Pittsburgh 30, Pa.
LINDBERG, JOHN A., Metallurgist, Struthers Wells Corp., Titusville Forge Div., Titusville, Pa.
ROBERTS, GEORGE A., Chief Metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa.

St. Louis District

ARDIS, L. R., Plant Manager, Norge Division, Borg-Warner Corp., 410 E. Maple St., Herrin, Ill.
GRANT, F. R., Director of Research, Consumers Cooperative Assn., 320 E. Tenth St., Kansas City, Mo.

Southern California District

GILFILLAN BROS., INC., A. J. Grobecker, Engineering Supervisor, 1815 Venice Blvd. Los Angeles 6, Calif.
CAIN, GORDON A., Vice-President, Standard Perlite Corp., Security Bldg., 234 E. Colorado St., Pasadena 1, Calif.

Washington (D. C.) District

INSTITUTO TECNOLOGICO DE AERONAUTICA, BRAZIL, F. P. Rebello, U.S.A. Representative, 1501 Eighteenth St., N. W., Washington 6, D. C.
SCRIBNER, BOURDON F., Chemist, National Bureau of Standards, Washington 25, D. C.
STOVER, ALBERT M., Director of Development, The Glenn L. Martin Co., 501 E. Preston St., Baltimore 2, Md.
VALORE, RUDOLPH C., JR., Materials Engineer, National Bureau of Standards, Washington, D. C.

Western New York-Ontario District

TITCHENER AND CO., E. H., R. F. Schreiber, Vice-President, 67 Clinton St., Binghamton, N. Y.
BENNETT, ROBERT W., Metallurgical Engineer, Alco Products Division, American Locomotive Co., Dunkirk, N. Y.
WHITE, CHESTER M., Director of Research, Genesee Research Corp., 573 Lyell Ave., Rochester 6, N. Y.

U. S. and Possessions

NEVADA, STATE OF, DEPARTMENT OF WEIGHTS AND MEASURES, W. B. Adams, State Sealer, Box 719, Reno, Nev.
PELLERIN, N. L., President, Pellerin Milnor Corp., 8000 Edinburgh St., New Orleans 18, La. (J)*
SHEEHAN, JOHN P., President, The Atlas Lime Co., Box 601, El Paso, Tex.
STILLINGER, JOHN ROBERT, Chief, Industrial Service Section, Oregon Forest Products Lab., Industrial Bldg., Seventeenth and May Sts., Corvallis, Ore.

Other than U. S. Possessions

AUSTIN MOTOR CO., LTD., THE, G. E. Swain, Superintendent of Labs., Longbridge Works, Longbridge, Birmingham 31, England.
CIA. DE REFINERIA DE AZUCAR DE VINA DEL MAR, Casilla 20-V, Valparaiso, Chile.
ENTHOVEN AND SONS, LTD., H. J., E. P. Harris, Director, 89 Upper Thames St., London E. C. 4, England.
GOODLASS WALL AND LEAD INDUSTRIES, LTD., Anthony Makower, Metallurgist, 14 Finsbury Circus, London E. C. 2, England.
STANDARD MOTOR CO., LTD., H. H. Jackson, Materials Engineer, Banner Lane, Coventry, England.
CENTRAAL NORMALISATIE BUREAU, Director, Lange Houtstraat 13A, The Hague, The Netherlands.
HEY, HARRY, Managing Director, Electrolytic Zinc Company of Australasia, Ltd., 360 Collins St., Melbourne, Victoria, Australia. For mail: Box 634, B.P.O., Hobart, Tasmania.
LABORATORIO DE ENSAYO DE MATERIALES E INVESTIGACIONES, TECNOLOGICAS DE LA PROVINCIA DE BUENOS AIRES (LEMIT), Pedro J. Carriquiriborde, Director, Calles 52 y 122, La Plata, Argentina.
LARSON, ERIK GUSTAF, Vice-President and Technical Director, AB Volvo, Goteborg, Sweden.
TAIT, G. EWING, Assistant Manager of Manufacturing, Dominion Engineering Works, Ltd., Box 220, Montreal, P. Q., Canada.

* [J] denotes Junior Member.

**San Francisco
October 10–14, 1949**

PERSONALS • • •

News items concerning the activities of our members will be welcomed for inclusion in the column.

NOTE—*These "Personals" are arranged in order of alphabetical sequence of the names. Frequently two or more members may be referred to in the same note, in which case the first one named is used as a key letter. It is believed that this arrangement will facilitate reference to the news about members.*

CORRECTION NOTE.—In the July "Personals" columns in listing the active A.S.T.M. members who were recipients of American Concrete Institute Awards we inadvertently neglected to indicate that **Harold Allen,** who was co-recipient of the Wason Medal with **Frank H. Jackson,** was an A.S.T.M. member. Principal Materials Engineer, Public Roads Administration, Washington, D. C., Mr. Allen has been a member for several years and is active in the work of a number of committees.

The American Institute of Bolt, Nut & Rivet Manufacturers will in the future be known as the Industrial Fasteners Institute. The Institute will continue its offices at 1550 Hanna Bldg., Cleveland 15, Ohio. The Institute, which is headed by Herman H. Lind, President, has a company membership in A.S.T.M., and through William C. Stewart, Technical Adviser, takes an active part in the work of various A.S.T.M. technical committees, particularly Committee A-1 on Steel.

Andrew A. Aines, formerly Industrial Engineer, Products Testing Div., The Quartermaster Board, Camp Lee, Va., is pursuing further studies at the Graduate School, University of Maryland, Psychology Dept., College Park, Md.

Herrick K. Allen is now associated with Strong & MacDonald, Inc., Tacoma, Wash. He was formerly Development Engr., National Forge & Ordnance Co., Irvine, Pa.

Earle H. Bell, until recently Asst. Instructor, University of Illinois, Urbana, is now with the Caterpillar Tractor Co., College Graduate Training Program, Peoria, Ill.

H. P. Bigler, Executive Vice-President of Connors Steel Co., Birmingham, Ala., has been made a member of the Industrial Relations Committee, National Association of Manufacturers.

Charles W. Blacketer, formerly Chief Chemist, Berry Bros. Division, American-Marietta Co., Detroit, Mich., is now Manager, Customer Service, Atlas Powder Co., Stamford, Conn.

Alfred R. Bobrowsky has accepted a position as Textile Consultant, Danmore Dress Co., Inc., Yonkers, N. Y.

H. B. Bowen, Chief of Motive Power and Rolling Stock for the Canadian Pacific Railway Co., Montreal, since 1928, retired recently after 44 years of service with the Railway. W. A. Newman, who succeeds Mr. Bowen, has been Manager of the Railway's Department of Research since its formation in 1945.

Wharton H. Clay has been named Secretary-Treasurer of the Perlite Institute, a national trade association of eighteen companies manufacturing the lightweight aggregate, perlite, used in the building industry. Mr. Clay was formerly Secretary of the National Mineral Wool Assn. The Perlite Institute offices are located at 35 West 53d St., New York City.

F. O. Cooper, Manager, Sheet and Strip Bureau, Metallurgical Div., Carnegie-Illinois Steel Corp., Chicago, has retired after 44 years' service.

Gustav Egloff, Petroleum Technologist and Director of Research, Universal Oil Products Co., Chicago, was elected President of the Western Society of Engineers at its annual election.

M. L. Enger recently retired as Dean of Engineering at the University of Illinois, Urbana, after 42 years of service. At ceremonies unveiling his portrait, which was painted by Prof. Charles E. Bradbury of the Department of Fine and Applied Arts of the University, Dr. Enger was paid homage by approximately 500 colleagues, alumni, students, and other friends. The portrait will be hung in the University's Engineering Library.

Philip C. Faith, formerly with the Fifth Avenue Coach Co. & Affiliates, New York City, has accepted a position with the Transmission & Gear Co., Production Control Dept., Dearborn, Mich.

Ray C. Giddings is now Chief Engineer, Red Lite Cinder Co., Little Lake, Calif. He was previously associated with the Transit Mixed Concrete Co., Corona, Calif., in a similar capacity.

John P. Gnaedinger, Theo. W. Van Zelst, and Carl A. Metz have recently expanded the activities of their firm, Soil Testing Services, Inc., 730 Madison St., Evanston, Ill., to include contracting for foundation borings, performing laboratory and field tests on soils to determine engineering properties, analyzing test results, and manufacturing a line of apparatus for performing engineering tests of soils.

Arthur Arnold Gobeille, formerly Asst. Chemist, Uxbridge Worsted Co., Inc., Woonsocket, R. I., is now Laboratory Technician, Wanskuck Co., Providence, R. I.

Earl B. Hall, until recently Materials Engr., U. S. Engineers Office, Los Angeles, is now Soil Mechanic Engr., Corps of Engineers, South Pacific Division Lab., Sausalito, Calif.

Lois V. Hans, formerly Chemist, Hercules Powder Co., Wilmington, Del,. has accepted a position as Laboratory Coordinator, St. Regis Paper Co., Deferiet, N. Y.

Albert C. Holler has resigned as research fellow in chemistry at the University of Minnesota to accept the position of Chief Analytical Chemist with the Twin City Testing and Engineering Laboratories, St. Paul, Minn.

Pieter Honig, formerly Director, Netherlands Indies Rubber Research Inst., Buitenzorg, Java, has been named Head, Dept. for Technical Development & Investigation, West Indies Sugar Corp., New York City.

Many of the friends and associates in the Society of A. M. Houser, long connected with the Crane Company, Chicago, and for years interested and active in A.S.T.M. work, will be interested to know that he retired as of July 30, and that in the fall he plans to move to Hendersonville, N. C., where he has purchased a home. After he moves from Chicago his address will be Route 5, Ewbank Drive, Hendersonville, N. C.

Herbert Insley, Chief of the Mineral Products Division, National Bureau of Standards, and **F. P. Hall,** Assistant Director of Research, Onondaga Pottery Co., were presented with the Ross Coffin Purdy Award of the American Ceramic Society at the Society's Annual Convention in Cincinnati. The first to be so honored, Drs. Insley and Hall were cited for their outstanding contribution to ceramic literature. They are the authors of the book "Phase Diagrams for Ceramists."

Arnold Ivan Johnson is now Materials Engineer, U. S. Department of the Interior, Geological Survey, Water Resources Branch, being presently in charge of the Hydrologic Laboratory, Lincoln, Nebr. Until recently Mr. Johnson was connected with the Nebraska Department of Roads and Irrigation Testing Laboratory. He had previously been in the U. S. Navy Service with the SeaBees, and in the employ of the Omaha Steel Works as Supervisor of Materials Testing.

Gunnard E. Johnson has retired from active duty as General Manager of the East Chicago, Ind., plant of The Eagle-Picher Co. He leaves the plant after thirty-one years of active duties in capacities from Research Chemist to General Manager. Previous to this time he had worked for The New Cornelia Copper Company in Arizona, the Arizona Copper Company at Morenci, and The Anaconda Copper Mining Company at Great Falls, Mont. Mr. Johnson plans to retire to his farm in the Catskill Mountains and spend part of the time with his family in Florida.

Norman W. Kelch is now Technical Director, Brick Manufacturers Assn. of Southern California, with headquarters at 553 S. Western Ave., Los Angeles.

J. O. Leech, an Honorary Member of the Society, formerly very active in the steel field, is located at Stop 13½ Troy Road, R. D. 1, Schenectady, N. Y. His son, Bob, is working in Schenectady, and Mr. and Mrs. Leech are located at the address indicated.

C. J. Knickerbocker, formerly Chief

Chemist, Consolidated Cement Corp., Fredonia, Kans., is now Chief Chemist and Asst. Superintendent, Carolina Giant Cement Co., St. George, S. C.

G. E. F. Lundel, retired Chief, Chemistry Div., National Bureau of Standards, and A.S.T.M. Past-President, is recipient of the A.C.S. 1950 Fisher Award in Analytical Chemistry, presentation being made at the 116th National Meeting of the American Chemical Society this month in Atlantic City.

Francis F. Lucas, Member of the Technical Staff, Bell Telephone Laboratories, New York City, retired as of September 1. One of the outstanding authorities in the field of metallography and metallographic testing, he has won many honors for his endeavors and has a long list of important contributions to this field including development of high-power metallography, ultraviolet microscopy, and others. In addition to the engineering field he has contributed much to the solving of many problems involved in health. His present address is 245 Rutledge Ave., East Orange, N. J.

Kenneth G. Mackenzie, Assistant to Vice-President, The Texas Company, New York City, and an A.S.T.M. Past-President, was one of three outstanding petroleum technologists to whom certificates of appreciation were awarded by the American Petroleum Institute at a dinner of the group's Refining Division in Houston, Tex.

W. H. Mahin, Chairman of Metals Research at Armour Research Foundation of the Illinois Institute of Technology, has been named Director of Research of the Foundation. Mr. Mahin will head a group of 411 scientists, engineers, and technicians who are at present working on 125 research projects for industrial and government sponsors.

George G. Manov has left the Radioactivity Section of the National Bureau of Standards to become the Chief of the Advisory Field Service Branch of the Isotopes Division, Atomic Energy Commission, Oak Ridge, Tenn. Dr. Manov's functions with this Branch will be to furnish advice on proper techniques of using isotopes and diminution of health hazards, with special emphasis on the uses of isotopes in industry.

Joseph Marin, Professor of Engineering Mechanics, The Pennsylvania State College, received a signal honor from the American Society for Engineering Education when at its Annual Meeting in June he was recipient of the George Westinghouse Award. This is given annually for distinguished contributions to the teaching of engineering students, and was awarded Professor Marin for his work in the field of applied mechanics, for his important contributions through research to a better knowledge of the use of materials, and for his many technical papers, and improvement in teaching materials. Professor Marin has been a member of A.S.T.M. since 1931.

J. B. Monier, formerly Research Chemist, Synthetic Resins, Ltd., Galt, Ont., Canada, is now affiliated with Chemical Compounds, Ltd., of the same city, in a similar capacity.

B. P. Mulcahy is now President of Fuel Research Lab., Inc., Indianapolis, Ind. He was previously associated with Cupola Operation & Coal Carbonization, of the same city.

J. N. Nanda, formerly with the Technical Education Scheme, Government of Punjab (India), New Delhi, is now with the Carnegie Institute of Washington, Dept. of Terrestrial Magnetism, Washington, D. C.

W. R. Patterson has been appointed General Superintendent of the Steel Department at the Torrance, Calif., plant of National Supply Co., and will also continue in his present capacity as Chief Plant Metallurgist.

C. R. Payne has been named President of the reorganized Electro-Chemical Supply and Engineering Co., Emmaus, Pa. Mr. Payne was formerly associated with the Atlas Mineral Products Co. of Pennsylvania at Mertztown.

Paul Beal Petty is now associated with The H. K. Ferguson Co., Cleveland, Ohio, as Mechanical Engr. He was previously with the Stacey-Dresser Engineering Div. of Stacey Bros. Gas Construction Co., of the same city.

Ching Pong Pei has accepted a position as Project Engr., American Steel Foundries, Granite City, Ill. He was formerly Research Engr., Locomotive Firebox Co., Chicago.

R. M. Reel, Technical Service Mgr., Dayton Rubber Export Co., Dayton, Ohio, recently returned from a three months' business trip through continental Europe, where he visited Denmark, Holland, France, Spain, Switzerland, and Norway, contacting various European companies to whom his company renders technical assistance. He reports that economic conditions, particularly in the Scandinavian countries, have improved considerably as compared with last year, when he made a similar trip. He feels that Marshall Plan aid plus the efforts of the people themselves have brought marked improvement in all nations visited except Spain.

Robert N. Repp is now affiliated with Industrial Tape Corp., New Brunswick, N. J.

Fred B. Riggan was recently appointed General Manager in Charge of Manufacturing, at Key Company's plant in East St. Louis, Ill. Mr. Riggan was advanced from the position of Foundry Superintendent, and Arnold E. Czechowicz, former Asst. Foundry Superintendent, was simultaneously advanced to the position of Foundry Superintendent.

Frederic J. Robbins, formerly Vice-President, Plomb Tool Co., Los Angeles, Calif., is now President, Sierra Drawn Steel Corp., of the same city.

Robert R. Rohrer, Assistant Director of Research, Armstrong Cork Co., Lancaster, Pa., has been elected Chairman of the Southeastern Pennsylvania Section of the American Chemical Society.

Carlton H. Rose has been named director of the newly formed Specifications Department of the National Lead Co., New York City. The new department will provide an integrated system of specifications and methods of test for company products and for the raw materials used in company plants, maintaining an up-to-date library, and will be in a position to serve as a liaison in specification matters between the company and specification-writing bodies.

John L. Savage, Consulting Engineer, U. S. Bureau of Reclamation, Denver, Colo., and internationally known civil engineer, was 1949 winner of the Washington Award made annually by a joint committee of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, and the Western Society of Engineers. Mr. Savage received the award "for his unselfish public service devoted to the creation of monumental hydraulic structures utilizing natural resources." In his acceptance address he discussed the Yangtze River Dam project under way in China. Mr. Savage has been with the Bureau of Reclamation since 1903 (except for an eight-year leave) in various engineering capacities.

Robert Safir, formerly with the Photovolt Corp., New York City, is now Development Engr., Electrophysical Instruments & Controls, New York City.

John H. Sandberg has opened a consulting business at 2039 Alta Vista St., Houston, Tex. He was formerly associated with the Emsco Derrick & Equipment Co., Houston, as Chief Metallurgist.

Adolph O. Schaefer, Assistant to the Executive Vice-President, Midvale Co., Philadelphia, has been appointed to the Research Committee of Franklin Institute, Philadelphia.

Frank T. Sisco, Director, Alloys of Iron Research, New York City, has been appointed Technical Director of the Engineering Foundation. The Foundation, joint research agency of America Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and American Institute of Electrical Engineers, sponsors and supports fundamental research in all fields of engineering.

Floyd O. Slate, formerly Asst. Professor & Research Chemist, Purdue University, Lafayette, Ind., is now Research Chemist, Dept. of Mechanics of Engineering, College of Engineering, Cornell University, Ithaca, N. Y.

Hubert C. Smith, Chief Metallurgist of Great Lakes Steel Corp., Ecorse, Mich., has been appointed Assistant Vice-President in Charge of Metallurgical Control. A former Chief Metallurgist for Otis Steel Co., Cleveland, he transferred to Great Lakes in 1936, becoming Chief Metallurgist there in 1943. The new post has been created at Great Lakes in recognition of the increased responsibilities for production quality which have accompanied the plant's expansion program.

William P. Smith is now Sales Engineer,

El-Tronics, Inc., Philadelphia. He was previously associated with the Baldwin Locomotive Works, Eddystone, Pa., in a similar capacity.

Foster Dee Snell, President, Foster D. Snell, Inc., New York City, and active in A.S.T.M. work, particularly in Committee D-12 on Soaps and Other Detergents, presented an interesting address when he received the Medal of the Society of Chemical Industry at the annual meeting of that group in Manchester, England, on July 13. His subject concerned detergents and detergency, and he pointed out that there were a great variety of surface-active agents and of types of surfaces to be cleaned, and predicted that some day there may be a method for measuring detergency which would make it possible to compare detergents for a particular job and evaluate the best one. Dr. Snell's complete address was published in August 8 *Chemical Engineering News*.

Thomas Spooner, one of the Society's most active members, retired on July 31 from his duties after 40 years of service at the Westinghouse Electric Corp. In addition to a notable record of service with his company he has likewise compiled a record of intensive work for A.S.T.M., notably in Committee A-6 on Magnetic Properties, of which he was Chairman for almost 25 years. He has served on several other committees and was Chairman of the Pittsburgh District Council on which he has held membership for many years. Mr. Spooner is relinquishing his Society activities later in the year. He is now making his home at 1366 West Lake Rd., Conneaut, Ohio.

E. K. Spring, Chief Metallurgist, Henry Disston and Sons, Inc., Philadelphia, is the incoming Chairman of the Philadelphia Chapter, American Society for Metals.

W. R. Toeplitz, Vice-President in Charge of Engineering Research, Bound Brook Oil-Less Bearing Co., Bound Brook, N. J., has been elected to its Board of Directors.

Gosta Vennerholm, Supervisor of Ford Motor Co.'s Metallurgical Research Section of the Process Engineering Laboratory, Dearborn, Mich., was awarded the William H. McFadden Gold Medal for contributions to the foundry industry. The award was presented at the 53rd Annual Convention of the American Foundrymen's Society recently held in St. Louis, Mo.

Stanton Walker, Director of Engineering, National Sand and Graval Assn., Washington, D. C., announces that the Association's laboratory has been moved to its new location in Building H of the Martin Engineering College in Washington. Extensive new equipment and facilities are being provided.

George E. Warren has been elected to succeed the late Frank H. Powell as President of the Southwestern Portland Cement Co., Mr. Powell, who died July 6, 1949, had been connected with the company for 42 years, having served as President since 1927. Mr. Warren, who was Company Vice-President, has been very active in the work of A.S.T.M and the Portland Cement Assn., has served on various A.S.T.M. technical committees, and is a former member of the Board. He has been located at the Osborn, Ohio, plant of Southwestern Portland for many years. His present headquarters are at 1034 Wilshire Blvd., Los Angeles, Calif.

George B. Waterhouse, Professor of Metallurgy, Emeritus, Massachusetts Institute of Technology, and Past-President of the American Society for Metals, was awarded the honorary degree of Doctor of Engineering by Nova Scotia Technical College.

Harry J. Wernert advises that the firm name of Forster, Wernert, Taylor & Fred M. Morris, Associate Engineers & Architects, 733 Nicholas Bldg., Toledo, Ohio, has been changed to Wernert, Taylor, Sanzenbacher & Morris.

A. E. R. Westman, Director, Department of Chemistry, Ontario Research Foundation, Toronto, Canada, is leaving on September 9, 1949, for England where he will visit industrial research laboratories and engage in studies in the Department of Physical Chemistry, Cambridge University, returning in June 1950. His address will be Flat 1, 9 Brunswick Walk, Cambridge, England. Dr. Westman is Vice-Chairman of Committee E-11 on Quality Control of Materials and Chairman of a task group who have just completed the revision of Supplement B of the A.S.T.M. Manual on Presentation of Data which will form Section 3 of the new A.S.T.M. Manual on Quality Control of Materials.

Charles S. Whitney, representing the firm of Ammann (**O. H. Ammann**) & Whitney, Consulting Engineers of New York and Milwaukee, received the first Annual Award of the Concrete Reinforcing Steel Institute "in recognition of a noteworthy contribution to the advancement of reinforced concrete construction." Mr. Whitney received the award on behalf of the firm for its paper entitled "Thin Shell Concrete Structures," presentation taking place at the 25th Anniversary Meeting of the Institute, held at White Sulphur Springs, W. Va., in July.

Wilbur M. Wilson, formerly Research Professor of Structural Engineering in the Civil Engineering Department of the University of Illinois, Urbana, now retired, was named the 11th winner of the Marston Medal for achievement in engineering, Iowa State College.

Charles C. Wright is now Vice-President, Oilwell Research, Inc., Long Beach, Calif. He was formerly associated with Seybold & Wright, Hollywood, Calif.

William F. Zerbe has been appointed Vice-President in Charge of Operations, a newly created position of Central Iron & Steel Co., Harrisburg, Pa., subsidiary of Barium Steel Corp. He formerly was General Manager of Operations, and will be succeeded in that post by H. M. Jones, his former assistant.

NECROLOGY

Ralph M. Bowman, Republic Steel Corp., Cleveland, Ohio (June 18, 1949). Representative of his company for many years on Committees C-8 on Refractories and C-16 on Thermal Insulating Materials.

E. R. Dillehay, Technical Director, The Richardson Co., Melrose Park, Ill. (January 25, 1949). Representative of company membership since 1933, and representative of his company on Committee D-11 on Rubber since 1938.

Charles Tyndale Evans, a Vice-President and Director of the Universal-Cyclops Steel Corp., Titusville, Pa. (May 13, 1949). Member since 1924. Mr. Evans, who succumbed to a heart ailment at the age of 76, had been associated with Cyclops Steel and Universal-Cyclops Steel Corp. since 1918, having done important development work on stainless steels in his earlier years, and successively serving as Chief Metallurgist and General Manager, and Vice-President and Director. He had continued in an active advisory capacity in the latter positions until his death.

Russell Greeves, Technical Director, Kelley Island Lime and Transport Co., Clay Center, Ohio (July 21, 1949). Mr. Greeves died at the George Washington University Hospital, Washington, D. C. He had suffered a stroke on July 20 while in Washington on a business trip. Mr. Greeves had been with Kelley Island Lime and Transport Co. for 26 years, and during the entire period had served as representative of his company on A.S.T.M. Committee C-7 on Lime. He had recently been named a member of the newly formed Committee C-20 on Acoustical Materials.

N. F. Harriman, San Diego, Calif. (June 29, 1949). Member since 1902. A long-time member of the Society, Mr. Harriman was associated with the Union Pacific Railroad Co., Omaha, Nebr., for many years. In 1926 he was appointed Vice-Chairman, Federal Specifications Board and Engineer-Physicist, U. S. Bureau of Standards. He later served as Chairman, Federal Purchasing Board, U. S. Bureau of the Budget, and subsequently was Technical Assistant to Director of Procurement Branch of Supply, Treasury Dept., Washington, retiring in 1947, and thereafter making his home in San Diego.

R. W. H. Hawken, Professor of Engineering, University of Queensland, Brisbane, Australia. Representative of University membership since 1920.

C. A. Hogentogler, Sr., formerly Senior Highway Engineer, Public Roads Administration, Washington, D. C. (June 18, 1949). Member 1934–1946. Well known as a pioneer in the soil mechanics field, Mr. Hogentogler was for many years a very active member of several A.S.T.M. committees, especially Committees D-4 on Road and Paving Materials and D-18 on Soils for Engineering Purposes, being the first chairman of the latter committee in 1936. In 1935 he was co-recipient with

Edward A. Willis (present Senior Highway Engineer of PRA) of the A.S.T.M. Dudley Medal, awarded for their paper entitled "Subgrade Soil Testing Methods."

BURKE HAYWOOD KNIGHT, Analytical and Consulting Chemist, 50 East 41st Street, New York City (July 20, 1949). Member since 1942. Member of Committee D-1 on Paint, and previously a consulting member of Committee D-9 on Electrical Insulating Materials.

LINWOOD G. MORT, Engineer, Argraves & Mort, New Haven, Conn. (July 4, 1949). Member since 1946.

ERNEST H. NICHOLS, Chief Engineer, The Funkhouser Co., Williamsport, Md. (June 14, 1949). Member since 1933, and active for many years in the work of Committees C-18 on Natural Building Stones, D-4 on Road and Paving Materials, and D-8 on Bituminous Waterproofing and Roofing Materials.

HARALD M. OLSON, Consulting Maintenance Engineer, Morton Salt Co., Chicago, Ill. (June 27, 1949). Member since 1941. Formerly Promotional Water Engineer, The Ohio Salt Co., Wadsworth, Ohio. Active in the work of Committee A-5 on Corrosion of Iron and Steel, also in Committee D-19 on Industrial Water and many of its subcommittees. An authority in the field of treating water, the Annual Water Conference, sponsored by the Engineers' Society of Western Pennsylvania, was Mr. Olson's conception and stands as an enduring tribute to his efforts over a period of many years.

KENNETH H. OSBORN, Structural Engineer and Vice-President, The Osborn Engineering Co., Cleveland, Ohio (June 25, 1949). Member since 1927. A member of A.S.T.M. Cleveland District Council, Mr. Osborn was nationally known as a consulting engineer and a designer of stadiums.

Notes on Laboratory Supplies

Catalogs and Literature; Notes on New or Improved Apparatus

This information is based on literature and statements from apparatus manufacturers and laboratory supply houses.

Catalogs and Literature

Corning Glass Works, Corning, N. Y. Bulletin B-83 entitled "Properties of Selected Commercial Glasses" and Bulletin B-84, "Manufacture and Design of Commercial Glassware," contain basic information about the important properties of glass and major glass manufacturing methods. B-83 covers mechanical properties, thermal stresses, heat transmission, electrical properties, corrosion resistance, viscosity data, etc. B-84 covers melting, blown glassware, blowing glass, blown glassware design, pressed glassware, pressing glass, tubing and rod, glass and metal assemblies, etc. Both, 8½ by 11 in., illustrated.

Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa. A four-page folder entitled "Unitized Laboratory Furniture" describes Drawer, Sink, Cupboard, Corner, and Table Units; also Wall and Floor Cases, Laboratory Tables, etc. Illustrated.

Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill. This four-page folder entitled "General Index to Gaertner Literature" consists of an alphabetical index of all of the instruments manufactured by the company and reference to the bulletin in which each is described. Also includes a list of more than 30 bulletins in print and in preparation.

E. H. Sargent & Co., 155–165 E. Superior St., Chicago 11, Ill. "Scientific Apparatus and Methods Including Latest Catalog Revisions"—Summer, 1949—includes chapters in Section One—Scientific Methods—on "Radio Frequency Measurement of Electrolytes Without Electrodes," and "The Polarography of Cadmium Techniques for Cutting Glass Tubing." Section Two—Scientific Apparatus—includes chapters on New Items, Reinstated Items, Discontinued Items, and Changes in Specifications. Illustrated.

Scientific Glass Apparatus Co., Inc., Bloomfield, N. J. A twelve-page folder, "Gyco Heating Jackets with Safety Thermostats," describes and illustrates various types of heating jackets and lists their features. Some of those described include: Tubular Heating Jackets; Jackets for Pyrex Brand Jars, Kjeldahl Flasks, Buchner Funnels, Erlenmeyer Flasks, Reaction Flasks, Desiccators, and Bottles. Accessories for use with Gyco Jackets are also described.

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Ill. "AB Polishing Machines for the Metallurgical Laboratory"—an eight-page folder illustrating and describing various models, such as low-speed polisher, standard polisher, deluxe polishing apparatus—various models of each type being listed. The Buehler-Waisman Electro-Polisher is also included with illustration and description.

Instrument Notes

Relaxation Machine—The Baldwin Locomotive Works, Philadelphia 42, Pa. Relaxation tests at temperatures up to 1800 F. can be carried out automatically, including a record of the rate of decline of load, by means of this new machine of 4000 lb. capacity. Relaxation occurs when a material is stretched to, and held at a given elongation, as in bolts, particularly at elevated temperatures. Creep then tends to elongate the bar and release the load. Elastic shortening balances this effect and total strain remains constant. Plastic elongation can be measured by the decrease in stress. Relaxation tests are also useful beyond the direct application of data on the behavior of metals at constant total strains.

New Dipping Refractometer—Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y. This refractometer is for testing various substances, one feature of it being its prism mount which provides interchangeability of dipping prisms and prevents seepage of liquids and vapors into the instrument's compensator parts. It also has a conical top for the focusing eyepiece which provides comfort to the user who wears spectacles, and has a smaller aperture in the end of the beaker to permit the light to enter the sample and prism correctly, cutting stray light to a minimum.

Mercury Still—Eberbach & Son Co., Ann Arbor, Mich. This new still produces high purity distilled mercury. The electronic controls are automatic; the still has start and stop buttons, and the operator needs only to supply raw mercury which begins to flow within 4 to 6 minutes after the start button is pushed. Automatic safety devices protect the unit which operates directly from 115 volt, 50-60 cycle a. c.

Forced Draft "Isotemp" Oven—Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa. This is for general laboratory use and performs drying operations quickly. The new oven has a motor-fan unit beneath the heating chamber and an arrangement of ducts and louvres which conduct hot, dry air to the heating chamber where the air moves against and completely around the sample. Once the selected operating temperature is attained, the new oven will maintain that temperature within plus or minus 1 deg. Heavy glass wool insulation, aluminum shelving and cast housing afford stability and even heat distribution.

Linear Comparator—The Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill. This Comparator is for Measurement of Spectrum Plates and similar records. It is of the moving stage type with an auxiliary stage for rapid alignment. Microscope power is adjustable from 4× to 34×. Model M1201-30B. Also, Model M1201-30BX Linear Comparator similar to the above, with cross motion stage.

New Portable Tensile Testing Machine Model PO-40—Steel City Testing Machines, Inc., Detroit, Mich. This machine is for making field tests where conventional testing equipment is not available. It is adaptable for testing pipe welds and other types of welds where on-the-job testing is preferable. Its use, however, is not limited to field testing, but is satisfactory both for laboratory and for shop testing.

New Hot Plate—Thermo Electric Manufacturing Co., Dubuque, Iowa. This is used for evaporations, boiling and general heating in the plant or modern laboratory. Its temperature range is 140 to 850 F; control is by means of a patented input controller which is automatically compensating for line voltage variations and maintains to close limits the working temperature desired. Two sizes are available, 12 by 12 in., and 12 by 24 in., and separate units are built for operation on 115 and 230 volts, 50/60 cycles a. c.

A Laboratory-Cast Pin Sample for the Spectrographic Analysis of Copper-Base Alloys[1]

By E. W. Palmer,[2] J. P. Irwin,[2] and C. C. Fogg[2]

SYNOPSIS

A practical and inexpensive method has been developed for preparing pins of standard size and shape from any form of metallic sample (wire, sheet, heavy bars, drillings, etc.) received for spectrographic analysis by a brass mill laboratory. The sample is reduced to fine chips, and a small portion (approximately 1 g.) remelted under argon in a specially designed graphite crucible which also serves as the mold in which the sample is solidified. The crucible and contents are heated in a small laboratory electric arc furnace.

Sample pins so prepared are machined to dimensions that vary with the excitation to be used and the elements to be determined. It is shown that even for alloys containing easily oxidized or easily vaporized elements, in the amounts usually encountered, the pin sample satisfactorily reflects the composition of the material prior to remelting. Replicate analyses can be made on the same pin by remachining.

Because the high conductivity of copper-base alloys makes these materials unusually sensitive to changes in electrode size and shape, this development of a standard sample makes possible, for the first time, really quantitative spectrographic work on the wide variety of forms and gages of alloys submitted to the brass mill spectrographer.

In an extended investigation aimed at developing methods for the quantitative spectrographic analysis of copper-base alloys, using an ARL-Dietert 1.5 m. grating spectrograph, several general requirements for satisfactory precision have gradually become evident. The following are believed to be of basic importance:

1. The entire source must be imaged on the grating.
2. One or both electrodes forming the source should be the solid metallic sample.
3. The size and shape of the sample electrodes should be identical with those of standard samples from which working curves are prepared.

The first requirement seems to be dictated by the fact that, in general, copper-base alloys contain elements of widely varying volatility (as, for example, copper, zinc, lead, and iron in a brass); when volatilization rates differ, the various zones of an arc or spark differ widely in amount of radiation characteristic of each element, and blocking off any portion of the discharge column may produce erratic results.

The second requirement simply summarizes our experience with various types of sample electrodes. Solution samples of copper-base alloys are difficult to dry reproducibly on electrodes, and in any case produce too large an arc to image satisfactorily on the grating. Dried powdered salts, with or without various buffers, also produce a large flaring arc and are somewhat time-consuming to prepare. Compressed pins or pellets tend to exfoliate during arcing, especially when volatile metals such as zinc are present, and in our experience have given extremely erratic results. Molten globules have been studied extensively, in various atmospheres (including helium and argon) as well as in air, but no really satisfactory results were obtained. The highly selective volatilization of various components in such a source is thought to be the major cause of its inconsistency. Incidentally, sources operated in the inert gases yield spectra very difficult to recognize, for the relative intensities of the various lines are markedly affected. The familiar spectra obtained from sources burned in air unquestionably owe much of their character to the formation and excitation of oxides. In general, we have obtained satisfactorily reproducible results only with solid metallic samples of the alloy to be analyzed, burned in air.

The third requirement, that the size and shape of the electrode be standardized, arises from the fact that the electrode temperature, and hence the relative degree of volatilization of the components of copper-base alloys, varies with electrode size and shape, because of the relatively high thermal conductivity of these materials. Only by using electrodes of identical shape and size have we been able to secure reasonably reproducible excitation. Particularly with respect to trace elements, samples smaller than the standard invariably give lines of higher density than normal, while larger than standard samples invariably show a decreased density of trace element lines.

Laboratory-Cast Pin Samples

As a result of our experience in trying to meet the above requirements, we have finally developed a small cast pin sample $\frac{3}{8}$ in. long and 0.177 in. in diameter, prepared in the laboratory from any form of metal received for analysis. Such pins are readily machined to a suitable standard size and shape and form a source small enough to be imaged readily on the grating. It has been experimentally established that pins can be prepared from a wide variety of copper-base alloys without significant change in composition with respect to the elements usually determined spectrographically. By mounting these pins in massive electrode holders with a standard length protruding, the pins can be remachined and used repeatedly while still maintaining standard electrode configuration.

The use of cast pin samples of somewhat larger dimensions, prepared from large heats of molten metal in the foundry or casting shop for spectrographic control purposes, is of course well known (see, for example, Wolfe and Jemal[3]). However, the casting of pins in the laboratory as a means of reducing all samples received to a common and desirable shape and size appears to be new, and seems to warrant a detailed description of our technique.

In preparing these pins, drillings or clippings, depending on the form of the incoming sample, are taken by the usual

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 1916 Race St., Philadelphia 3, Pa.

[1] Presented at a meeting of Committee E-2 on Spectrographic Analysis, held in Atlantic City, N. J., June 30, 1949, during the Fifty-Second Annual Meeting of the Society.

[2] The American Brass Co., Waterbury, Conn.

[3] R. A. Wolfe and E. J. Jemal, "Quantitative Spectrographic Analysis of Copper Alloys," ASTM Bulletin, No. 129, August, 1944, pp. 45–52.

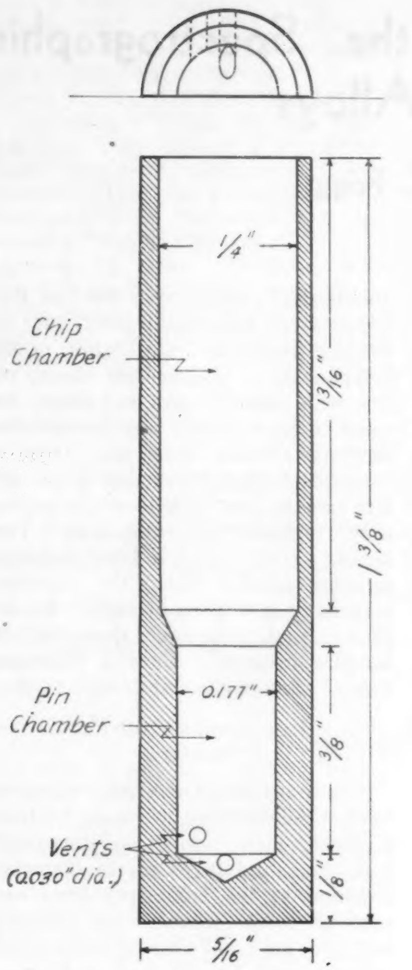


Fig. 1.—Section of Graphite Crucible-Mold.

The drill used in forming the chip-chamber has a 30-deg. point; the pin-chamber drill has a standard 59-deg. point.

sampling techniques. Clippings may be used directly, but drillings are further cut up to give roughly equiaxed particles. The ideal individual sample chip is a tiny cube; this shape of chip can be mixed thoroughly with others of its kind, it will pack easily into a small crucible, and has had a relatively small surface exposed to tool contamination.

A representative portion of the chip sample is then weighed out. For the size of pin mentioned above, on which this laboratory has standardized, a sample weight of 1.20 g., ±10 mg., is used. The weighed portion is placed in a small crucible-mold, a new one for each sample, prepared in the laboratory from $\frac{5}{16}$-in. graphite rod of spectroscopic grade. Fortunately, the solubility of carbon in copper-base alloys is quite low; and graphite crucibles have been found satisfactory even for cupronickels.

Figure 1 is a sketch of a crucible-mold, showing the larger upper chamber into which the chips are placed, the tapered throat, and the lower chamber into which the molten metal runs to form the pin. The pin cavity is vented near its base to permit escape of entrapped gas. Vent holes should be no larger than 0.030 in. diameter, to retain molten metal in the mold. The diameter of the pin chamber, 0.177 in., was selected as the smallest that would fill satisfactorily with all types of copper alloys under present casting conditions; larger pins have been cast without difficulty.

For heating the crucible-mold to a temperature sufficient to melt the charge of chips, a high-frequency induction furnace would seem to have many advantages. Thus far, however, the melting has been carried out in an improvised indirect arc furnace (see Fig. 2) in which twin arcs in series play upon the outside of a graphite tube, the bore of which forms a closely fitting chamber into which the crucible-mold is dropped. An inert-gas atmosphere is maintained both inside and outside of this tube to prevent oxidation of the sample and the graphite parts of the furnace; argon at approximately 1 liter per minute is used. A slight positive pressure inside the furnace opposes convection currents which would otherwise introduce air and causes gases introduced with samples and crucibles to be diluted and swept away.

Small additions of a suitable flux aid the coalescence of the melting chips; potassium chloride has been found especially useful for this purpose. A few small crystals are added to each crucible when the chips have attained a bright red heat. For alloys containing aluminum, larger quantities of flux may be necessary and may be mixed with the chips prior to charging.

The crucible-mold is removed from the furnace as soon as its charge has melted, as observed by means of a mirror mounted above the furnace. Dropping the crucible a short distance, or tapping it lightly, forces the molten metal downward to fill the pin-cavity. The mood is then chilled by grasping it at its base with cold closely fitting metal tongs. The metal charge solidifies rapidly from the bottom, so that each pin has a fine cast structure, and any shrinkage occurs near the top, where it is

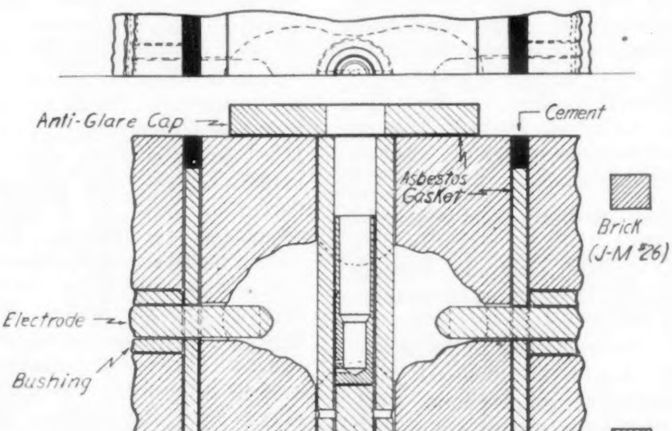


Fig. 2.—Improvised Laboratory Arc Furnace for Heating Crucible-Mold.

of no importance since it is the bottom end of the pin that is machined for analysis. After the furnace has been brought to working temperature, pins can be cast at the rate of about 100 to 150 per hr.

To prepare a pin for use as an electrode in the spectrographic source, it is first given a short acid dip to obtain a clean surface for electrical and thermal contact, and is then machined to a shape which depends on the particular analysis to be performed. The various shapes used have been established experimentally as giving the maximum reproducibility consistent with the sensitivity required in a given determination.

In the cases so far tested, segregation has caused no difficulty in the spectrographic analysis of these cast pins. The small dimensions of the crucible and sample cause the metal to freeze rapidly with a fine structure, and the various elements appear to be distributed evenly throughout the pin. This has been substantiated by repeated spectrographic analyses of the same pins, remachined between analyses; many pins have been reused until they could no longer be gripped in the holders.

TABLE I.—COMPARISON OF ORIGINAL METAL AND CAST PINS.
(Chemical Analyses)

Billet	Iron, per cent		Manganese, per cent	
	Original Drillings	Cast Pin	Original Drillings	Cast Pin
No. 1...	0.42	0.41	0.48	0.47
	0.42	0.41	0.49	0.46
	0.41	0.43	0.49	0.47
	0.41	0.41	0.48	0.45
	0.41	0.41	0.49	0.46
	0.41	0.42	0.48	0.47
No. 2...	0.39	0.39	0.48	0.47
	0.39	0.38	0.48	0.46
	0.39	0.37	0.49	0.47
	0.38	0.38	0.49	0.46
	0.39	0.38	0.49	0.46
	0.39	0.39	0.48	0.47

In the early stages of development of the casting technique, many pins were more or less porous throughout. Porosity fine enough to be invisible to the eye was found to have a very small effect on reproducibility; large gas holes or shrinkage cavities may affect results very strongly. In our present casting practice, porosity has been eliminated at the sampled end of the pin by chilling the base of the mold, as described above.

Reliability of Cast Pins

Cast pins have been prepared as described above for a variety of copper-base alloys and studies made of their reliability as spectrographic samples. In general, they have been found closely representative of the material from which they are prepared. There is some small loss of zinc from a high brass, but zinc is not determined spectrographically in this alloy; the loss of zinc from a tin or silicon bronze, where it is present as an impurity and is determined, appears to be negligible. The chief problem has been to avoid the loss, during the melting operation, of easily oxidizable constituents. This has been satisfactorily minimized by conducting the melting operation in an inert atmosphere.

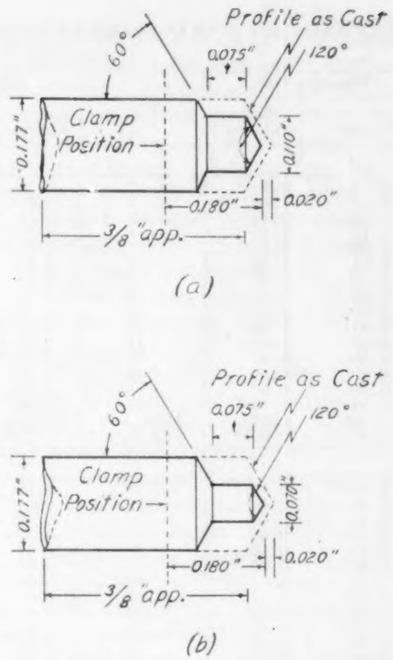


Fig. 3.—Cast Pins Machined to Electrode Form.

Shape (*a*) is a typical electrode for spark analyses; shape (*b*) is used in determination of arsenic by d-c. arc method.

The determination of iron and manganese in a 70–30 cupro-nickel provides an example of the results obtained with alloys having easily oxidizable constituents. This alloy contains an appreciable amount (0.4 to 0.8 per cent) of the readily oxidizable element manganese; it also requires a higher casting temperature than any other commercial copper-base alloy.

Comparison of the chemical analyses of the same metal before and after casting is shown in Table I. Two cast sample-billets as received from the casting shop were each drilled in six places. The drillings from each hole were kept separate, half being taken for chemical analysis and the other half cast into a sample pin. Each pin was machined as if for spectrographic analysis, and then, after cutting off the porous "set" end, dissolved completely and analyzed chemically. The precision of chemical analysis for manganese with such small samples is not high, and scatter of ±0.02 per cent would be expected.

Consideration of Table I indicates that the iron content is unaffected by the casting operation, but a slight consistent loss of manganese, approximately 5 per cent of the amount present, is indicated. Since working curves are derived from pins prepared in exactly the same fashion, only the possible variation of the loss of manganese incident to casting is significant, and in view of the small loss this is considered negligible.

For the spectrographic analysis of this alloy, sample pins are machined to the form shown in Fig. 3 (*a*); it will be noted that the pin tip is a 120-deg. cone and that the diameter has been reduced to 0.110 in.

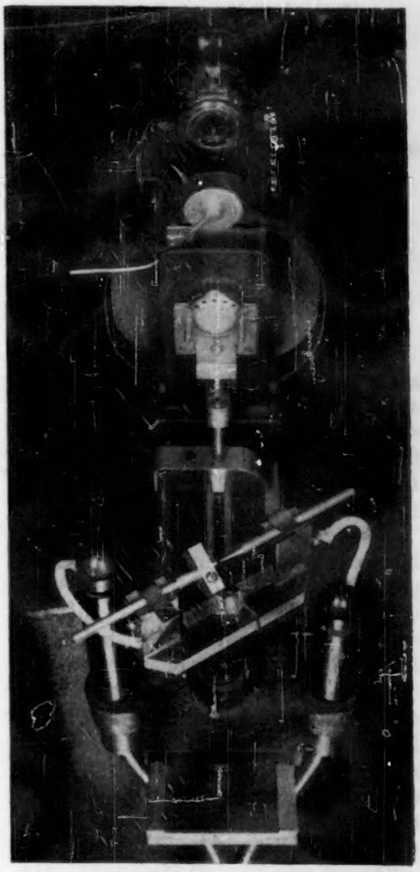


Fig. 4.—Optical Bench Arrangement Using Sample Pin Electrode and Graphite Counter Electrode.

After mounting the pin in a massive holder, the holder is fixed in the spark stand with the pin axis horizontal at optical axis level and turned so that the pin axis makes a horizontal angle of 55 deg. to the optical axis. At this angle, all radiation from the electrode cone is "visible" from the slit.

The counter-electrode is a $\frac{1}{4}$-in. graphite rod (spectroscopic grade) with an 18-deg. cone tip cut off to give a flat face 0.040 in. in diameter. Its axis is aligned with the sample axis, and a

TABLE II.—COMPARISON OF WROUGHT AND CAST PINS IN SPARK ANALYSIS FOR IRON AND MANGANESE.

	Cast Pins			Wrought Pins	
	Original	Re-machined		Original	Re-machined
Group I (Iron)					
No. 1......	0.42	0.41	No. 1.....	0.41	0.40
2......	0.40	0.41	2.....	0.40	0.40
3......	0.38	0.40	3.....	0.41	0.39
4......	0.39	0.39	4.....	0.41	0.40
5......	0.41	0.39	5.....	0.39	0.40
6......	0.41	0.40	6.....	0.41	0.40
7......	0.40	0.40	7.....	0.40	0.40
8......	0.39	0.39	8.....	0.41	0.41
9......	0.41	0.40	9.....	0.40	0.39
10......	0.42	0.39	10.....	0.41	0.39
11......	0.39	0.40	11.....	0.39	0.39
12......	0.40	0.39	12.....	0.39	0.40
13......	0.40	0.41	13.....	0.40	0.39
14......	0.39	0.40	14.....	0.39	0.40
15......	0.40	0.40	15.....	0.39	0.40
Mean......	0.401	0.399	Mean......	0.401	0.397
Std. dev.....	0.0112	0.0072	Std. dev....	0.0085	0.0057
Group II (Iron)					
No. 16......	0.39	0.39	No. 16.....	0.40	0.40
17......	0.39	0.40	17.....	0.40	0.41
18......	0.40	0.42	18.....	0.40	0.40
19......	0.40	0.40	19.....	0.40	0.40
20......	0.39	0.41	20.....	0.41	0.40
21......	0.39	0.40	21.....	0.40	0.40
22......	0.38	0.40	22.....	0.41	0.41
23......	0.39	0.39	23.....	0.39	0.42
24......	0.39	0.40	24.....	0.39	0.40
25......	0.40	0.39	25.....	0.39	0.41
26......	0.39	0.40	26.....	0.40	0.40
27......	0.39	0.40	27.....	0.38	0.39
28......	0.38	0.40	28.....	0.39	0.40
29......	0.39	0.40	29.....	0.39	0.41
30......	0.40	0.40	30.....	0.39	0.40
Mean.......	0.391	0.400	Mean......	0.396	0.403
Std. deriv...	0.0061	0.0072	Std. dev....	0.0080	0.0070

	Cast Pins			Wrought Pins	
	Original	Re-machined		Original	Re-machined
Group I (Manganese)					
No. 1.....	0.58	0.59	No. 1.....	0.60	0.59
2.....	0.59	0.60	2.....	0.60	0.61
3.....	0.58	0.60	3.....	0.60	0.59
4.....	0.58	0.59	4.....	0.61	0.59
5.....	0.61	0.59	5.....	0.61	0.59
6.....	0.58	0.59	6.....	0.61	0.60
7.....	0.58	0.59	7.....	0.59	0.60
8.....	0.59	0.58	8.....	0.61	0.59
9.....	0.58	0.60	9.....	0.60	0.57
10.....	0.62	0.60	10.....	0.61	0.59
11.....	0.59	0.59	11.....	0.60	0.60
12.....	0.60	0.59	12.....	0.60	0.62
13.....	0.58	0.58	13.....	0.60	0.59
14.....	0.61	0.59	14.....	0.59	0.60
15.....	0.60	0.59	15.....	0.59	0.60
Mean......	0.591	0.591	Mean......	0.599	0.595
Std. dev....	0.0131	0.0062	Std. dev....	0.0076	0.0109
Group II (Manganese)					
No. 16.....	0.61	0.59	No. 16.....	0.57	0.62
17.....	0.61	0.59	17.....	0.61	0.61
18.....	0.59	0.59	18.....	0.59	0.62
19.....	0.64	0.59	19.....	0.59	0.61
20.....	0.61	0.62	20.....	0.61	0.60
21.....	0.60	0.59	21.....	0.59	0.60
22.....	0.60	0.60	22.....	0.61	0.61
23.....	0.61	0.59	23.....	0.60	0.62
24.....	0.61	0.61	24.....	0.59	0.59
25.....	0.61	0.59	25.....	0.61	0.60
26.....	0.59	0.60	26.....	0.60	0.59
27.....	0.62	0.59	27.....	0.54	0.59
28.....	0.61	0.60	28.....	0.59	0.57
29.....	0.63	0.62	29.....	0.59	0.60
30.....	0.62	0.62	30.....	0.59	0.60
Mean......	0.611	0.601	Mean......	0.592	0.602
Std. dev....	0.0129	0.0119	Std. dev....	0.0176	0.0133

glass spacer mounted on a pivoted spark-stand fixture determines the standard 2-mm. gap and simultaneously fixes the lateral position of the gap on the optical axis. The general arrangement is shown in Fig. 4.

The power supply is an ARL-Dietert high-voltage spark unit, set at lowest power ($\frac{2}{3}$ kv., 0.007 μf), and lowest inductance (No. 1, 0.045 mh.). Manual controls on this unit are adjusted during the pre-spark period, when necessary, to bring the primary and secondary circuits to standard levels, as determined from their voltmeters. For this analysis, the spark unit timer is set for 30 sec., the operator opening a shutter in the optical path after 15 sec. of pre-sparking to allow a 15-sec. exposure.

The standard spark-gap position is 46.7 cm. from the slit; a 20-cm focal length spherical quartz lens is placed 21.5 cm. from the slit; and a screen filter of suitable transmission is mounted as near the lens as fittings permit. Slit width is 0.050 mm. With the grating open wide, this optical arrangement images the metallic electrode cone face and the spark itself on the ruled area of the grating, and the exposure of 15 sec. gives the internal standard line Cu II 2703.2 a transmission value of about 40 per cent, using Eastman Spectrum Analysis No. 1 film developed for extreme contrast (6 min. in D-19 developer at 65 F.).

Transmission values are measured with an ARL-Dietert comparator-densitometer; readings are taken for lines Fe II 2755.7, Mn 2933.1, and the internal standard Cu II 2703.2. The transmission values are converted to relative intensities by means of a film calibration curve, and working curves, prepared using pins of known compositions, convert relative intensities to percentages of iron and manganese.

In order to obtain a direct comparison of laboratory cast pins with the original material, a coil of 70–30 cupro-nickel wire of pin diameter was secured and 30 pins machined directly from the wire. Then 30 more pins were cast from chips of the wire and machined to shape. These 60 pins were spectrographically analyzed by the above procedure in two lots run on different days, each lot consisting of 15 wrought pins and 15 cast pins. After sparking, each lot of pins was remachined to shape and a repeat series of analyses made. The data are given in Table II.

It is evident from the data that the process of pin preparation by laboratory casting has had no adverse effect on the spectrographic analysis of this alloy. (The slight loss of manganese indicated by chemical analysis in Table I does not appear in this work, and consequently is most probably ascribable to the small sample of cast material used in the chemical comparison.) Spectrographically, the wrought and cast pins are indistinguishable. The results show excellent reproducibility, and it is noteworthy that remachining the pins after one sparking yields a new surface quite as satisfactory as the original.

A method used in this laboratory for the determination of arsenic in admiralty metal (Cu 70, Sn 1, As 0.05, Zn bal.) illustrates the applicability of the cast-pin sample to an alloy containing small amounts of a somewhat volatile element. This technique employs a 2.5-amp. d-c. arc (250 v. on open circuit). The cast-pin sample is machined to a smaller diameter than for spark analysis; details are shown in Fig. 3 (*b*).

The arsenic contents of six admiralty bars, cast especially for spectrographic standards, were established by careful analysis by a spectrophotometric method, under research conditions. Cast pins were then prepared from drillings and analyzed in triplicate by the spectrographic technique. The same bars were also run in triplicate by the routine spectrophotometric method. The results are shown in Table III.

It is evident that the spectrographic method using a cast-pin sample gives results quite as good as the routine spectrophotometric method. The spectrographic technique is normally used because it permits detection of unusual impurities when they occur and provides for accurate estimation of common impurities. Lead and iron are detected

TABLE III.—PRECISION OF ARSENIC DETERMINATIONS.

Bar	Arsenic, per cent		
	Spectrophotometric (Research)	Spectrographic (Routine)	Spectrophotometric (Routine)
No. 5121	0.022	0.022	0.022
		0.021	0.023
		0.025	0.024
5122	0.035	0.037	0.039
		0.033	0.033
		0.036	0.036
6117	0.040	0.038	0.036
		0.034	0.037
		0.039	0.035
5123	0.049	0.049	0.050
		0.043	0.051
		0.047	0.050
5124	0.059	0.062	0.062
		0.056	0.061
		0.061	0.062
5125	0.073	0.071	0.075
		0.075	0.067
		0.070	0.074

frequently and are estimated by the use of additional standards.

Advantages of Cast Pins

The following advantages of the cast-pin sample, for copper-base alloys, are apparent:

1. Any form of metal sample may be reduced to a standard size and shape, the use of which effects a substantial improvement in the precision of quantitative spectrographic analysis.
2. Composite samples may be prepared by careful mixing of small pieces before taking a representative portion for casting. (Many specifications for copper-base alloys permit composite sampling. Here our spectrograph has previously been at a disadvantage, for to compete with the single chemical determination several spectrographic determinations on the individual samples had to be made and averaged.)
3. It is not necessary to stock spectrographic standards in several different physical forms.
4. Standard alloys are conserved, because a single pin can be used repeatedly. A single analysis uses up only a very small amount of the sample.
5. This reuse of pins conserves small "unknown" samples, since one pin may be used for replicate determinations; a pin may also be remachined and analyzed in a d-c. arc, for "minor" constituents, after it has been sparked for major constituents.
6. The sample is quickly prepared, in the laboratory, at small cost per sample.

Application of Technique to Other Metals

It seems probable that this cast-pin technique is applicable to several other metals. Satisfactory results have been obtained in this laboratory in preliminary experiments with lead and zinc, though it has been found necessary to solidify the molten pin as rapidly as possible, to minimize segregation. Tin should be easy to prepare. Aluminum and magnesium may offer possibilities if sufficiently powerful but nonreactive fluxes can be found.

Ferrous materials and nickel alloys probably cannot be prepared in graphite crucibles, because of high carbon absorption, and hence are not readily susceptible to handling by the cast-pin technique.

Conclusions

Electrodes of reproducible size and shape for spectrographic analysis may be made, by casting, from copper-alloy samples of any form. The technique requires only a small amount of sample and can be performed quickly and cheaply in the laboratory. The electrode so cast has been found to be representative of the original metal and is adaptable to all types of spectrographic analysis by suitable mechanical shaping. Such samples are believed to be superior in many respects to other types previously used.

Investigation of Square Sub-sized V-Notched Charpy Specimens[1]

By Donald C. Buffum[2]

Synopsis

Impact data over a range of temperatures are presented for the standard and for several sub-sized, square, V-notched Charpy specimens. These data are for one steel which has been given a single heat treatment.

The effects of a reduction in cross-sectional area and of small changes in the notch upon the temperature of transition from ductile to brittle fracture are shown.

The transition temperatures are taken from graphs in which the impact energy and the per cent fibrous fracture are plotted as functions of the testing temperatures. Four of the many definitions for transition temperature are used to compare the data.

The impact energy values obtained from breaking sub-sized specimens on the small machine have been in good agreement with those values obtained from breaking similar specimens on the standard machine.

With the increasing necessity of using smaller sized test specimens, it is desirable to know how the data obtained from sub-sized specimens compare with those from the so-called standard specimens. It is the purpose of this paper to correlate the data from sub-sized V-notched Charpy impact bars with data from standard V-notched Charpy specimens.

Of the literature reviewed, only one paper revealed previous work on the effect of the size of V-notched Charpy specimens on the transition temperature. This was a report[3] from this Arsenal which indicated that the apparent transition temperature is decreased with reduction of the cross-sectional area. However, it should be noted that the specimens in this previous investigation did not have their dimensions reduced proportionately

In the present report three groups of sub-sized specimens were used.

Material and Test Procedure

Group I.—All dimensions except length decreased proportionately.

Group II.—Same as group I except that the radius at the bases of the notch was that of the standard size specimens.

Group III.—Same as group I except that the notch was shallower and had a smaller radius at the base.

If standard machines are to be used

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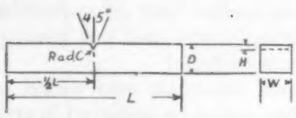
[1] The statements and opinions in this article are those of the author and do not necessarily express the views of the Ordnance Department.

[2] Watertown Arsenal Laboratory, Watertown, Mass.

[3] D. E. McCarthy and J. H. Hollomon, unpublished work, Watertown Arsenal.

for testing Charpy specimens, it is impossible to reduce the length of the bar proportionately with the other dimensions; therefore most tests were made with bars of standard length.

TABLE I.—DIMENSIONAL CHARACTERISTICS OF SPECIMENS.



All dimensions to be ±0.002 in. except radius at bottom of notch which shall be within 0.001 in. and the angle of the notch which shall be ±1 deg.

Dimensions of Specimens, in.

Specimen Type[a]	L	D and W	H	C
Group I				
½	2.16	0.197	0.039	0.005
½S	1.40	0.197	0.039	0.005
¾	2.16	0.296	0.059	0.0075
Group II				
½R	2.16	0.197	0.039	0.010
½SR	1.40	0.197	0.039	0.010
¾R	2.16	0.296	0.059	0.010
Group III				
½N	2.16	0.197	0.0195	0.0025
¾N	2.16	0.296	0.039	0.005
Standard				
Std	2.16	0.394	0.079	0.010

[a] S = short length. R = standard notch radius. N = shallow notch. Std = standard V-notched Charpy bar.

The specimens used in this investigation were machined from hot-rolled S.A.E. 3140 bar stock of $\frac{5}{8}$ in. diameter. The chemical analysis showed the material to be of the following composition (in per cent):

Carbon	0.385	Phosphorus	0.015
Manganese	0.79	Nickel	1.26
Silicon	0.30	Chromium	0.77
Sulfur	0.028	Molybdenum	0.02
Vanadium	<0.01		

Blanks from which the specimens were machined were heat treated in 0.420-in. squares 2.16 in. long. They were austenitized at 925 C. (1700 F.), held 1 hr. at temperature and air cooled. After this they were tempered at 650 C. (1200 F.) for 1 hr. and water quenched. This treatment produced a structure of tempered bainite with about 5 per cent tempered martensite. The austenitic grain size was A.S.T.M. 8[4] and the Rockwell C hardness of the tempered specimens was 18 to 22. After heat treating, the specimens were machined to the dimensions indicated in Table I. Ten specimens of each size were used to obtain the transition curves.

With the exception of the short length specimens, all bars were tested on a standard 217 ft-lb. Charpy machine whose striking velocity is 16.8 ft. per sec. The standard gage length of 1.57 in. was used. The striking head was designed according to the specifications described in A.S.T.M. Tentative Methods of Impact Testing of Metallic Materials (E 23 - 47 T).[5]

[4] Classification of Austenitic Grain Size in Steels (E 19 - 46), 1946 Book of A.S.T.M. Standards, Part I-A, p. 682.

[5] 1947 Supplment to Book of A.S.T.M. Standards, Part I-A, p. 381.

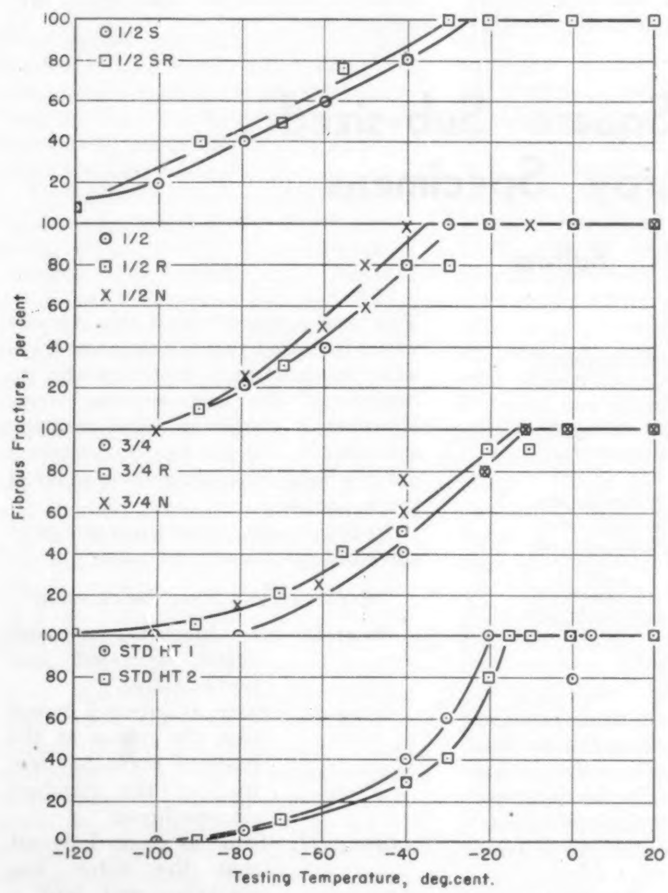


Fig. 1.—Fibrous Fracture as a Function of Testing Temperature.

S = Short Length. R = Standard notch radius. N = Shallow notch radius. Std = Standard.
NOTE.—Test specimens have dimensions shown in Table I.

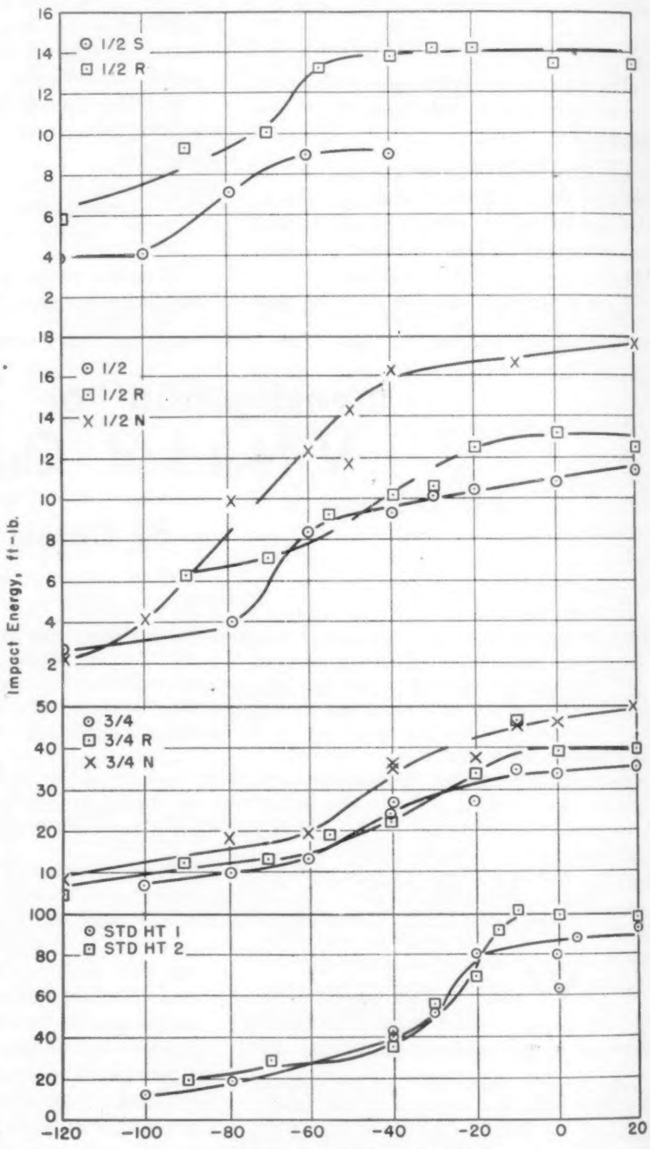


Fig. 2.—Impact Energy as a Function of Testing Temperature.

S = Short Length. R = Standard notch radius. N = Shallow notch radius. Std = Standard.
NOTE.—Test specimens have dimensions shown in Table I.

The short length bars were tested on a small impact machine with a capacity of 16 ft.-lb. The striking velocity was 11.5 ft. per sec. The striking edge had a radius of 0.109 in. and the distance between supporting edges of the specimen anvils was 1.0 in.

TABLE II.—TRANSITION TEMPERATURES, DEG. CENT.

Definition	Group I			Group II.			Group III		Standard[a]	
	½	½S	¾	½R	½SR	¾N	½N	¾N	H.T. 1	H.T. 2
1............	−28	−25	−10	−28	−30	−13	−30	−13	−19	−16
2............	−55	−70	−37	−55	−75	−75	−63	−45	−33	−26
3............	−73	−95	−53	<−90	−108	−108	−82	−55	−38	−33
4............	−69	−83	−43	−53	−70	−70	−70	−48	−32	−27

[a] Standard heat treatment 1 and heat treatment 2 values are taken from curves made from two separate groups of standard size bars heat treated at different times.

Results and Discussion

The data collected in this investigation are plotted in Figs. 1 and 2. Figure 1 presents the per cent fibrous (ductile) fracture of the specimens as a function of the testing temperature. Figure 2 presents the impact energy of the specimens as a function of the testing temperature.

In analyzing impact data, there are many criteria by which the investigator may compare the data. In recent years many of the investigators have used either the transition temperature or the transition range. The definitions for transition temperature or range, however, are very numerous. In this paper the data will be analyzed using four of the many possible definitions. The first of the following definitions is the one being used at this Arsenal for transition temperature.

1. The transition temperature is the lowest temperature at which 100 per cent fibrous fracture is obtained, as taken from the per cent fibrous *versus* testing temperature curve.
2. The transition temperature is that temperature at which the fracture is 50 per cent fibrous, as read from the per cent fibrous *versus* testing temperature curve.
3. The transition temperature is that temperature at which the energy is one half the value obtained at the lowest temperature at which the fracture is 100 per cent fibrous.
4. The transition temperature is that temperature at which the energy absorbed is one half the sum of the values obtained at the lowest temperature at which the fracture is 100 per cent fibrous and the highest temperature at which the fracture is zero per cent fibrous.

Table II presents the transition temperatures for various groups of bars as obtained using the above definitions.

On studying Table II it will be noted that the most uniform transition temperature, regardless of specimen size, is obtained by using definition 1. Also note that in any group of specimens the reduction in cross-sectional area decreases the transition temperature. This verifies the earlier information.[3]

As shown by studying the groups, the effect of changing the radius of the notch on any given sized bar is small. Therefore, since it would facilitate the machining of specimens to use the radius of the standard bar in all specimens (group II), it is recommended that this be done.

The use of the shallow notch (group III) increases the impact value obtained from fracturing the specimens; however, the transition temperature decreases. The increase in impact value is believed to be caused by the increase in the cross-sectional area under the notch of the specimen.

Conclusions

1. Regardless of size of specimen, the most uniform transition temperature, considering several criteria, is obtained using the definition: "The transition temperature is the lowest temperature at which the specimen breaks with 100 per cent fibrous fracture, as taken from the per cent fibrous fracture *versus* testing temperature curve."
2. The transition temperature is decreased by reducing the cross-sectional area of the specimen.
3. The effect of small changes in the notch radius is negligible. Therefore, since it would facilitate machining, it is suggested that the standard notch radius be used in all bars.
4. The shallow notch increases the impact energy by increasing the area under the notch; however, the transition temperature is lowered.
5. When it is necessary to reduce the size of the Charpy specimen it appears advantageous to use as large a sub-sized specimen as possible with the standard V-notch (group II).

A Rapid Photoelectric Method for Determination of the Relative Color Density of Liquids*

By Louis Lykken[1] and John Rae, Jr.[1,2]

As an indication of the purity or degree of refinement of many products, color is often the only criterion that is readily available to and appreciated or understood by the consumer. The measurement of color is a very useful research tool, particularly for following the course of chemical reactions in purification, aging, and oxidation studies. Moreover, with modern improved photoelectric colorimetric equipment, color considerations are becoming increasingly important and useful to the research chemist. For these reasons, methods for measuring color are of widespread interest to the chemical industries.

The several methods available for the complete description of color require the use of prohibitively expensive equipment or involve somewhat complex visual measurements. Moreover, the results obtained by these comprehensive methods are unnecessarily complicated for many purposes. In many instances, a measure of the total transmittance of a given test material in the visible region of the spectrum is sufficient for the color description required and, indeed, is often more useful than spectrophotometric analysis in the study of certain types of chemical reaction, such as oxidation, and more readily translatable into terms of physiological significance.

It is evident that any specification method should give the same results regardless of the peculiarities of the particular apparatus or instrument used. Since different colorimeters may not give the same response even when they are of the same make and since the re-

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* An abstract of a paper published in *Analytical Chemistry*, Vol. 21, p. 787 (1949).

[1] Shell Development Company, Emeryville, Calif.

[2] Present address: Shell Oil Company, Inc., Houston, Tex.

sponse of a given instrument may change significantly from month to month, any specification method for the measurement of color density should be designed to compensate for variations in colorimeter response. Such variations have been compensated for in the present method by use of an easily prepared, single comparison standard for a number of products, having the same general spectral characteristics and covering an approximately twenty-fold color concentration range. Auxiliary comparison standards are used for relatively dark and relatively light liquids.

The comparison standards are of the Gardner-type, and consist of an aqueous solution of iron and cobalt chlorides acidified with hydrochloric acid. These standards are easily prepared, universally reproducible, and stable indefinitely provided they are kept at a moderate room temperature (20 to 25 C.). They have the further advantage of having been generally accepted by industry and tested over a period of years in various commercial visual color methods.

In the present method the relative color density of a liquid is obtained by measuring the optical density of the liquid and of a given color comparison standard, using any of several commercially available photoelectric colorimeters equipped with a specified broad band light filter, a suitable light reduction mask, and light absorption cells of specified depth having parallel, planar faces. The relative color density of the test material is calculated by dividing its optical density by that of the color comparison standard. The result obtained is, therefore, a direct comparison of the color density of the test material to that of the standard. It is of physiological significance because the light filter is chosen so that the net response of the colorimeter approximates the response of the normal eye. Moreover, as a consequence of Beer's law, relative color density is, to a fair approximation, proportional to the color concentration in the test material. For example, a relative color density of 2.00 simply means that the test material is twice as dark as the comparison standard, a value of 1.00 indicates that the test material has the same color density as the standard, and a value of 0.00 indicates "water-whiteness."

The relative color density method is empirical inasmuch as the value obtained is of significance only when expressed with relation to the color comparison standard used and, to a lesser extent, with relation to the length of the light path used. It does not indicate the hue of the sample but merely measures the total light absorption of the sample; thus, it is possible for samples visually differing in hue to have the same relative color density.

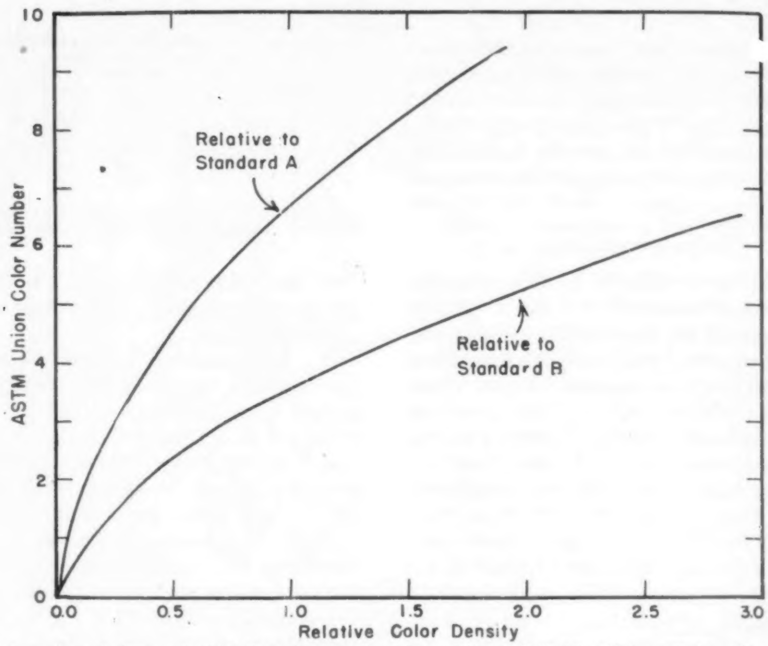

Fig. 1.—Correlation of Relative Color Density with A.S.T.M. Union Color Number.

In order to check the reproducibility and general usefulness of the proposed method, the relative color density of sixteen samples of petroleum products and colored aqueous solutions were determined on five commercially available photoelectric colorimeters. Good agreement was obtained for those samples in which the relative color density values were between 0.1 and 2.0. In this range, the average deviation from the mean of the relative color density value for a single sample ranged from 0.01 to 0.04. The average deviation from the mean of the relative color densities for a single sample, expressed in per cent, ranged from 1.0 to 12.5 per cent, with an average relative error of 4.4 per cent. The relative color density data obtained with the dark auxiliary standard showed an average relative error of 11.6 per cent.

Sixteen samples were cooperatively tested in a program sponsored by Subcommittee VI on Color of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants. Relative color density measurements were made in accordance with the described method in twelve different laboratories using a total of seven different makes of photoelectric colorimeters. The data obtained demonstrated that the reproducibility of the method in different laboratories, using common photoelectric colorimeters, is approximately the same as the precision found in the authors' laboratory.

A.S.T.M. Union color numbers and color densities relative to standards A and B were obtained for sixty samples of lubricating oils representing twelve commercial brands. The precision of the relative color density values was found to be considerably better than that of the visual method when the deviations are considered on a relative percentage basis. In order to correlate color data made in the past with that made by the new system, the graph shown in the accompanying Fig. 1 was prepared to show the relation between the A.S.T.M. Union Color numbers and the Relative Color Densities.

Summary:

The relative color density method is designed particularly as a specification or control method for lubricating oils and similar products, but is generally applicable to any nonaqueous or aqueous solution. It is particularly applicable to materials, such as petroleum products, which show predominant absorption in the near-ultraviolet portion of the visible spectrum. The method is most precise when applied to samples having color densities close to that of the comparison standard (relative color density of unity), especially when the spectral characteristics of the test material are similar to that of the standard. The precision decreases rapidly with increasing color density values greater than 2.

During the past two years, the relative color density method has given satisfactory results for a variety of materials, especially those in the color density range of standards A and B. It has been particularly useful in following the color changes occurring in experiments involving oxygen degradation of materials such as lubricating oils, gasolines, motor fuel blends, solvents, and polymers. It has also given considerable aid in determining the degree of refinement or purity of many chemical preparations.

A Torsion Testing Machine of 2,000,000 Inch-Pound Capacity

By F. K. Chang[1], K. Endre Knudsen[1], and Bruce G. Johnston[2]

Synopsis

A torsion testing machine of 2,000,000 in-lb. capacity has been designed and constructed at the Fritz Engineering Laboratory of the Lehigh University Civil Engineering Department. This machine can test specimens up to 4 ft. 4 in. in diameter, 16 ft. long, and can apply twists through any desired angle. The torque is applied by turning an 88-in. diameter rotating head by means of a 4 by $\frac{1}{4}$-in. flat wire rope, using an old model standard Riehle testing machine as the power source. To measure the applied torque accurately, aluminum torque tubes mounted with SR-4 gages are inserted at one end of the stationary head. These are of various ranges to give desired sensitivity. The head, in turn, rests on rollers which permit longitudinal movement when the specimen shortens during the twist.

The machine consists largely of weldments, made up from standard rolled bars and plates. The apparatus is self-equilibrating under the load; only a few foundation bolts are needed to keep it in place.

A research program on torsion was resumed at the laboratory in October, 1947, under the sponsorship of the Research Corporation of New York, N.Y. It was planned to test to destruction full size bolted, riveted and welded plate girders.

The available 24,000 in-lb. and the previously constructed 750,000 in-lb. torsion testing machines[3] in the laboratory were not capable of meeting the requirements of capacity or specimen dimensions, and the construction of a torsion testing machine of larger capacity became a requisite. Ten different alternative designs were studied, and the present one was adopted as being most economical and convenient. The present machine was completed on December 15, 1948, through the financial assistance of the Institute of Research of Lehigh University, Pennsylvania Department of Highways, in cooperation with the Public Roads Administration, and Research Corporation, principal sponsor of the program.

The authors also acknowledge the generous donations made by the John A. Roebling's Sons Co., Trenton, N. J., and the Aluminum Company of America, Pittsburgh, Pa., in the forms of the flat wire rope and aluminum tubes, respectively, used in the construction of the machine. The Lehigh Structural Steel Company has contributed the initial series of test specimens.

Fig. 1.—General View of the Machine.

The Requirements of the Machine

In developing the design the following requirements were set up:

Capacity.—2,000,000 in-lb. Reasonably large box girders and full size plate girders may be tested with a machine of this capacity.

Maximum Size of Specimens.—The machine was to be capable of accommodating specimens up to 16 ft. in length and at least 4 ft. in diameter.

Angle of Twist.—Any angle desired.

Speed.—Assuming that a 45-deg. twist will cause failure and that the minimum time required to reach this condition be $\frac{1}{2}$ hr., the rotating head was to have a maximum speed of

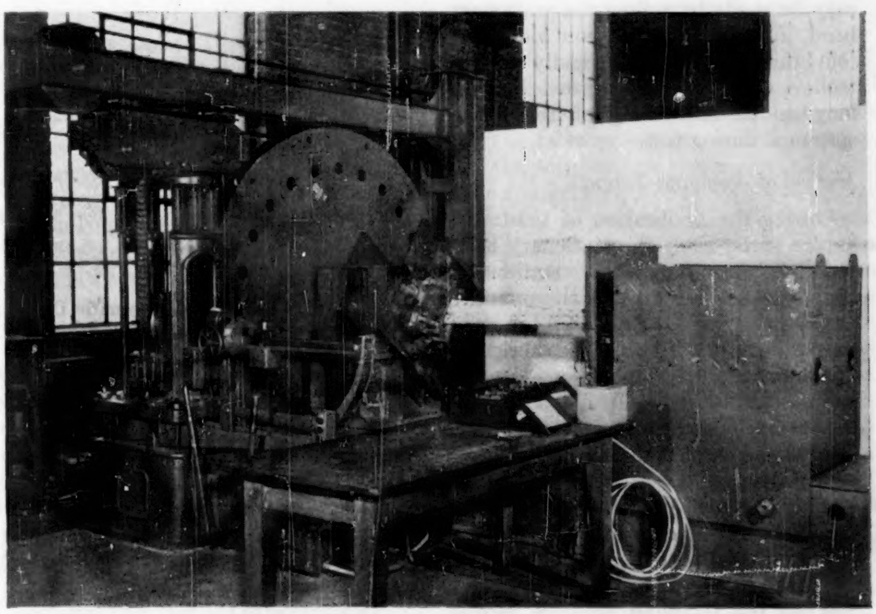

Fig. 2.—Close-up View of the Machine.

Note.—Discussion of this paper is invited, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 1916 Race St., Philadelphia 3, Pa.

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[2] Director, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa.

[3] Bruce G. Johnston, "Torsion Testing Machine of 750,000 in-lb. Capacity," *Engineering News Record*, Vol. 114, No. 9, p. 310, February 28, 1935.

approximately 1/240 rpm. In order to reach this condition in a longer period of time or to apply a small increment of load in an appreciable period of time, several slower speeds down to at least 1/5000 rpm. were to be provided.

Accuracy in Measuring the Applied Load.—The probable error of measurement was to be less than 0.5 per cent of the applied torque at any load within the range of any particular test.

Shortening Arrangement.—The grips should permit the specimen to shorten without developing appreciable longitudinal stresses during twist.

Design of the Machine

The machine, illustrated in Figs. 1 and 2, is approximately 9 ft. high and 24 ft. long. Its gross weight is 15 tons. The centerline of the machine is 46 in. above the floor level. Details of the various components are as follows:

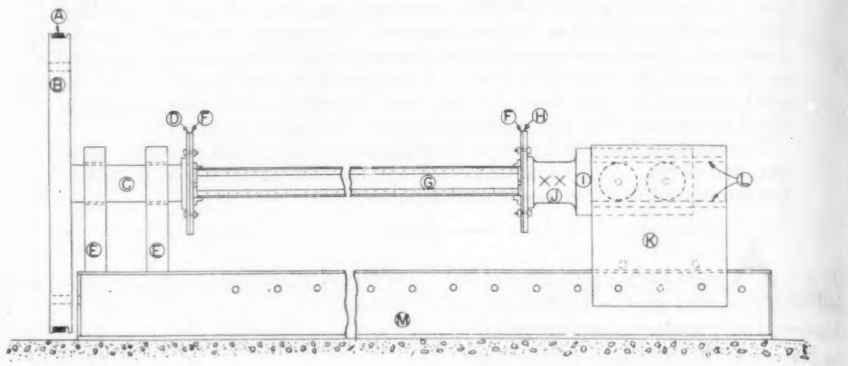
Method of Gripping:

In Figs. 3 and 4, the specimen, *G*, is held at both ends by the fixture plates, *F*, which in turn are bolted to the rotating face plate, *D*, and the stationary face plate, *H*. Two rings of holes are drilled in the fixture plates and the face plates in the same pattern. The use of eight bolts in either ring will develop 2,000,000 in-lb. torque. Angles and lugs are welded to the fixture plates to apply the torque and to hold the specimen, care being taken to permit longitudinal movement and provide thereby a free-end condition. To accept various lengths of specimens, the trolley, *K*, may travel along the total length of the base beam, *M*, and be locked by two 3-in. diameter pins to the base beam in positions varying by one-foot steps. The intermediate length adjustments may be made by rolling the stationary head, *I*, in either direction along the four rails, *L*, fastened rigidly to the trolley, this same device providing free longitudinal shortening of the entire specimen during test.

Method of Applying Torque:

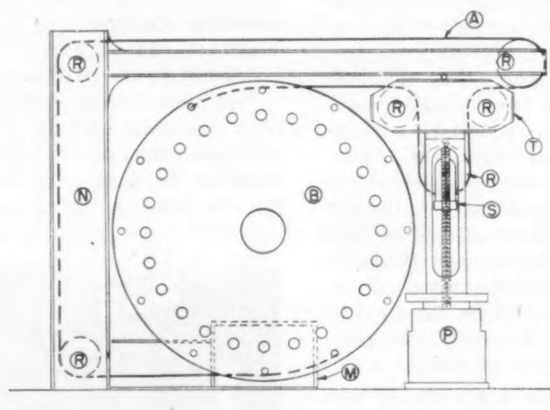
During the application of twist, the fixture plate, *F*, at the stationary head end remains practically stationary, while the fixture plate at the opposite end rotates as it transmits the torsional moment from the main wheel, *B*. Torque is applied to the 88-in. diameter main wheel by using an old 50,000-lb. Riehle machine already available at the laboratory, supplemented by a belt and pulley arrangement as shown in Fig. 4. The arrangement induces no bending in the Riehle machine and also enables one to weigh the force applied on the rope, *A*, by means of the testing machine scale.

When the traveling head, *S*, moves down, the main wheel is turned in a clockwise direction. The stroke of the traveling head is 24 in., which will rotate the main wheel through an arc of 30 deg. In case the required angle of twist is greater than 30 deg., the wheel can be locked to the end of the base-beam by inserting 3 pins in the holes of the inner ring of the main wheel which are spaced 15 deg. apart. The holes in the outer ring, spaced 30 deg. apart, are used to fasten both ends of the rope to the main wheel.



Ⓐ- Flat Wire Rope
Ⓑ- Main Wheel ⎤
Ⓒ- Main Shaft ⎬ Rotating Head
Ⓓ- Rotating Face Plate ⎦
Ⓔ- Bearings & Pillow Blocks
Ⓕ- Fixture Plates
Ⓖ- Test Specimen
Ⓗ- Stationary Face Plate ⎤ Stationary
Ⓘ- Box Beam on Rollers ⎦ Head
Ⓙ- Torquemeter
Ⓚ- Trolley
Ⓛ- Rails Fastened to the Trolley
Ⓜ- Base Beam

Fig. 3.—Front View Schematic Diagram of the 2,000,000 in-lb. Torsion Testing Machine.



Ⓐ - Flat Wire Rope
Ⓑ - Main Wheel
Ⓜ - Base Beam
Ⓝ- Pulley Frame
Ⓟ- Standard Riehle Testing Machine
Ⓡ- Pulleys
Ⓢ- Travelling Head of the Riehle Machine
Ⓣ- Additional Fixed Head on Riehle Machine

Fig. 4.—End View Schematic Diagram of the 2,000,000 in-lb. Torsion Machine.

By moving the traveling head to its uppermost position, the two rope sockets can be moved one hole, respectively, in a counterclockwise direction, thus taking up on the rope. The three pins can then be pulled out and another stroke of the testing machine head applied. By repeating this process, any desired angle of twist may be obtained.

In addition to the two different speeds on the machine, it is also possible to operate it by a hand wheel for very small increments of load.

The various possible speeds of the torsion machine corresponding to the twists of the specimens meet the requirement set up before.

Method of Measuring the Applied Torque:

The applied torque can be calculated approximately from the given diameter of the main wheel and the tensile load in the flat rope. The force in the flat rope is equal to one-half of the load recorded on the Riehle machine scale. Due to the friction created at the pulley bearings and the bending of the rope, the applied torque is not measured directly by this method.

To measure the applied torque directly, an aluminum alloy torquemeter tube mounted with SR-4 gages, Fig. 5, is inserted at the stationary head end. The gages on the torquemeter are

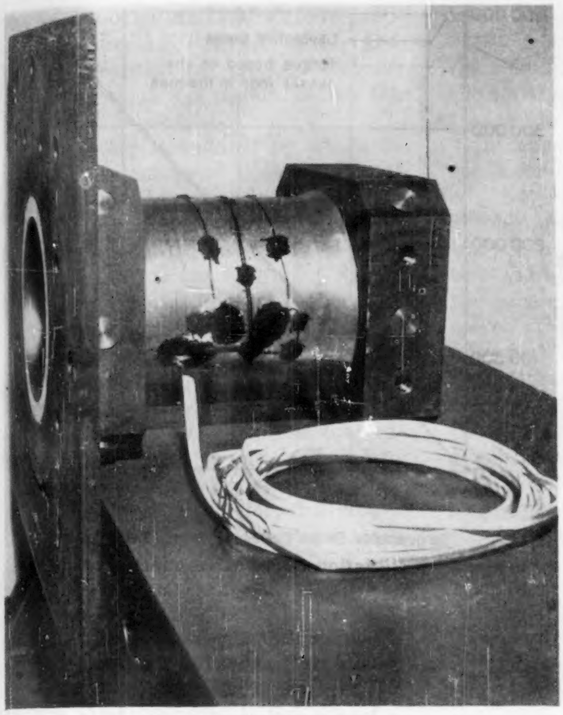


Fig. 5.—The Torquemeter.

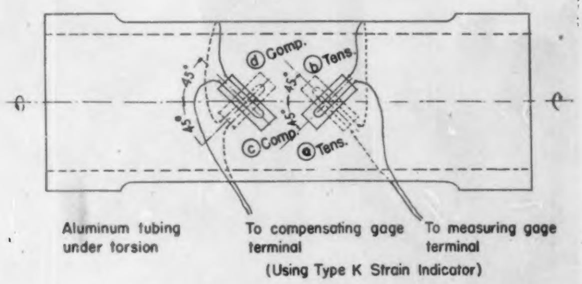


Fig. 6.—Location of SR-4 Gages on the Torquemeters.

arranged in such a way that gages *a* and *b* are subject to tension and gages *c* and *d* to compression during the twist, and are connected to the type *K* indicator in such a manner that the bridge output is doubled, Fig. 6.

Another advantage in using this type of connection is that strains in the torquemeter, due either to bending or vertical shear, caused by the dead weight of the specimen, do not record on the indicator. All four gages are located along the mid-depth of the tube where the average strain in each gage due to bending equals zero. The shear stress due to vertical load produces strain in gages *a* and *b* equal in magnitude and opposite in sign; therefore, being connected in series, they cancel out automatically. The same applies to gages *c* and *d*. The torquemeter also compensates strains due to temperature. Therefore, only the strain due to torque on the tube will be recorded on the indicator. The increment in the torquemeter strain readings should be directly proportional to the torque applied, if the torquemeter is stressed below its proportional limit, and the relation can be found by the method of calibration as described later. Three torquemeters of different range are used.

	Load Range Within Which the Probable Error of Load is Less Than 0.5 per cent
Torquemeter A (0 to2,000,000 in-lb.	100,000 to 2,000,000 in-lb.
Torquemeter B (0 to 500,000 in-lb.	40,000 to 500,000 in-lb.
Torquemeter C (0 to 100,000 in-lb.	10,000 to 100,000 in-lb.

Shortening Arrangement:

Specimens usually will shorten when torque is applied, especially in the plastic range, and longitudinal stresses will be set up if both ends of the specimen are held firmly in a longitudinal direction. In order to avoid such restraint, the stationary head rests on four rollers mounted on self-aligning roller bearings. Free movement is thereby permitted along the four rails fastened rigidly to the trolley, Figs. 3 and 7. The amount of shortening is measured by the Ames dials attached to the trolley. This arrangement also provides means for fractional adjustment for different specimen lengths as described before. High bearing stresses will be developed between the rails and the rollers; therefore special alloy steel is used.

Self-Equilibrium Under Twist:

The machine reaches self-equilibrium under the load. The total torque is transmitted by the base beam, Fig. 3, which is a 20- by 30-in. box beam 24 ft. in length, and built up of four $\frac{5}{8}$-in. plates welded at the four corners with stiffeners at 2-ft. intervals. When the specimen is under twist, a clockwise torque is applied to the base beam through the stationary head and the trolley. This is balanced by the counterclockwise torque applied at the end of the base beam, through the pulley frame, *N*, by the force in the flat wire rope, as shown in Fig. 4. When the wheel is locked to the end of the base beam and no tension is introduced in the rope during take-up, the latter torque is supplied by the reaction of the pins and the horizontal reaction on the main shaft, *C* (Fig. 3). No foundation is necessary. However, regularly spaced bolts are used to keep the machine in place and provide some additional rigidity from the floor.

Operation of the Machine

The operation of the machine is very simple, as follows:

First, the main wheel is locked to the end of the base beam by means of the three pins. The traveling head of the Riehle machine is moved to its topmost position. After choosing the proper position for the rope socket, in order to make the rope tight, the properly prepared fixture plates are bolted on and the specimen is set in position. The three pins locking the main wheel to the end of the base beam must be removed before the load can be applied.

The applied torque may be measured approximately by the Riehle machine and accurately from the torquemeter readings, as stated previously. It is essential that the proper range torquemeters be selected for each specimen.

Proof-Test and Calibration

The machine has been proof tested to its maximum capacity, 2,000,000 in-lb. by bolting the face plate of the rotating head directly to the face plate of the stationary head and then applying the load. No appreciable permament set was developed in any part of the machine.

The torquemeters were calibrated independently by the use of dead weight and a cantilever arm.

The relation between the increments in the torquemeter strain readings and the applied torque obtained by using the method of calibration checks very closely with the result using the tensile load in the rope multiplied by the distance between rope centers to obtain the applied torque. Both these results also check closely with theoretical relations based on the dimensions of the torquemeters and the known elastic constants of the material given in the *ALCOA* handbook. However, the calibrated value is used. The calibration curve of the torquemeter *B* is shown in Fig. 8 for illustration.

Initial Research Projects

A study of the shearing stress distribution, torsional stiffness, and useful

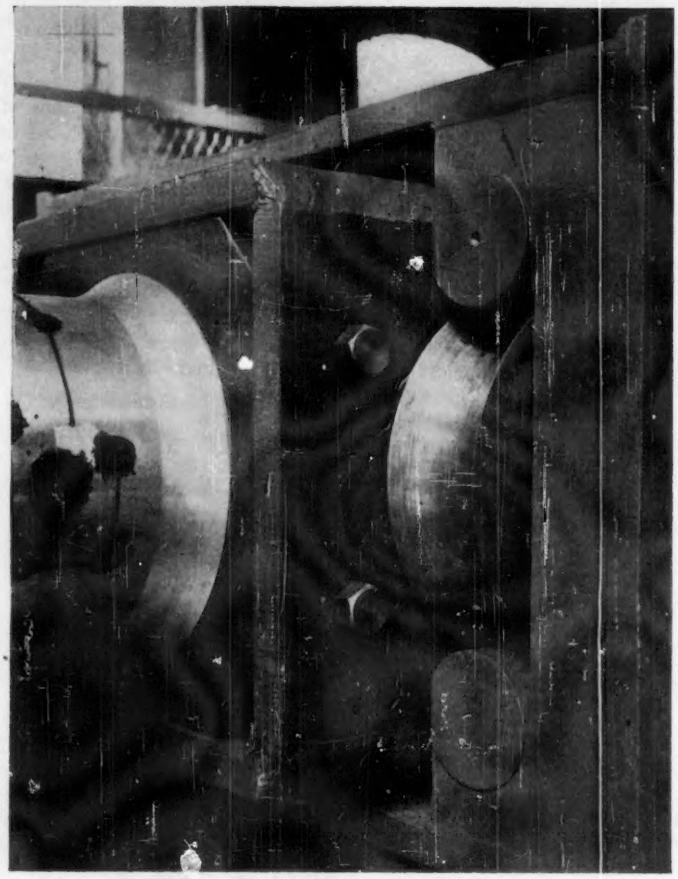


Fig. 7.—Stationary Head on Rollers.

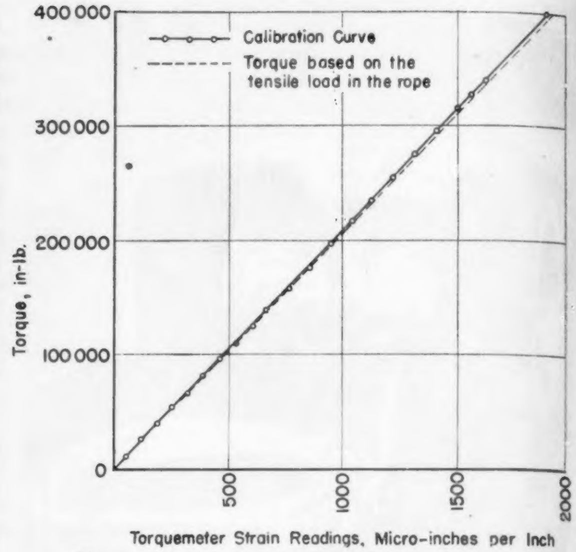


Fig. 8.—Calibration Curve of Torquemeter *B*.

and ultimate torsion capacity of riveted and welded plate girders under uniform torsion is now in progress, under sponsorship of Research Corporation of New York City and the Pennsylvania Department of Highways.

Formulas will be developed for calculating the pitch of rivets or bolts, or the sizes of welds, for the riveted, bolted, or welded plate girders, respectively, in order to approach the solid-section behavior under torsion. When the pitch of the rivets or bolts or the sizes of welds are given or determined by conventional methods, it should be possible to predict the torsional stiffness of the plate girders.

In the initial program, tests will be made of 15 full-size specimens. The specimens consist of three built-up plate specimens, along with five bolted, five riveted, and two welded plate girders, with a variable number of cover plates, variable rivet pitch, with or without stiffeners, variable tension in bolts for the bolted type, and a variety of girder sizes up to 4 ft. deep and 16 ft. long.

The investigation also includes a study of stress concentrations and over-all effects of transverse holes on built-up structural members under torsion.

Later investigations will include tests on riveted and bolted box sections.

Laboratory Testing of Resistance of Traffic Paint to Bleeding

By Fred S. Byerly[1]

EDITOR'S NOTE.—Mr. Byerly, as Chairman of Group IV on Bleeding of Subcommittee IV on Traffic Paint of A.S.T.M. Committee D-1 on Paint, Varnish, Lacquer, and Related Products, has prepared this article which outlines some of the work carried out in the group leading to the development of A.S.T.M. Standards on Bleeding of Traffic Paints.

BLEEDING, as defined by the Society[2], is "the diffusion of coloring matter through a coating from the substrate; also the discoloration arising from such diffusion." In this discussion we use the term "bleeding" as manifested by "discoloration."

When traffic paints are applied to bituminous surfaced roads, bleeding will generally occur owing to the diffusion of the dark-colored substrata through the light-colored paint film. The direct cause may be attributed to the solvation of those bitumens which are soluble in the vehicle portion of the paint. The degree or intensity of bleeding is dependent on (1) the type of bituminous surface, that is, oil, asphalt or coal tar, and (2) the extent to which these bitumens are solvated by the traffic paint film. The purpose of this paper is not to teach the formulation of traffic paints nor to advise the adoption of any particular type, but to present data on laboratory methods that were investigated in order to establish the Tentative Method of Laboratory Test for Degree of Resistance of Traffic Paint to Bleeding (D 969–48 T) published by the Society.[3]

Two-steps, which were considered necessary for determining the amount of bleeding induced by a traffic paint, were

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[1] Manager, Resin Technical Sales Dept., U. S. Industrial Chemicals, Inc., New York, N. Y.

[2] Standard Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products (D 16–47), 1947 Supplement to Book of A.S.T.M. Standards, Part II, p. 187.

[3] 1948 Supplement to Book of A.S.T.M. Standards, Part II, p. 217.

set up as objectives by the group functioning under A.S.T.M. Committee D-1 on Paint, Varnish, Lacquer, and Related Products, which was responsible for the method.

1. A set of standards by which to gage the intensity of discoloration of traffic paint films that have been applied to a road surface or, expressed in terms better suited to A.S.T.M. practice: Evaluating the Degree of Resistance of Traffic Paint to Bleeding. (A.S.T.M. methods rate complete resistance as ten and total lack of resistance as zero.[4])

2. A laboratory method of test for determining the amount of bleeding resistance possessed by any traffic paint without resorting to actual road paint-outs. The standards referred to above would be used for evaluation of these test films.

The first objective of the group was attained with the establishment of photographic standards in A.S.T.M. Standard Method of Evaluating Degree of Resistance of Traffic Paint to Bleeding (D 868–48).[4] These pictorial reference standards consist of four photographic reproductions illustrating the following degrees of bleed resistance:

No. 8 (slight bleeding)
No. 6 (moderate bleeding)
No. 4 (bad bleeding)
No. 2 (very bad bleeding)

In each case it is to be emphasized that the degree of bleeding is a contrast rating of the paint applied over a non-bleeding surface *versus* the same paint applied over a bleeding substrate. For example, if the colors of the dried and aged (48 hr.) paint film over the non-bleeding surface and over the bleeding substrate are the same, the rating is 10 (perfect resistance or no bleeding); but to take the other extreme, if the color depth of the paint film over the bleeding substrate is equivalent to that of the substrate itself, the rating is zero (complete lack of resistance to bleeding).

Upon the approval of the photographic standards as Method D 868, the attention of the group was devoted to the second objective. The methods devised for obtaining the standards of Method D 868 were considered of sufficient simplicity and accuracy to serve as the starting point for the second objective mentioned above.

In order to avoid confusion due to similarity of the titles of the two methods, let us point out that the photographic prints of Method D 868 are arbitrary standards that provide a comparative yardstick for visually evaluating the amount of bleeding that has occurred after application of the paint to a surface. The subject under discussion in this paper concerns the development of a *laboratory method* of applying the traffic paint over a specimen panel which bleeds similarly to the more severe bleeding type of bituminous roads so as to serve as a basis for judging the bleed resistance of paint between buyer and seller, without resorting to road tests.

In establishing such a laboratory test it is necessary that the method must:

1. Give bleeding intensity equivalent to the more severe road surfaces, but be sensitive enough to show up differences in bleeding induced by various types of paints.

2. Require simple apparatus that is inexpensive enough to be set up and used by the average manufacturer and user of traffic paints.

3. Show small enough variation in results by different operators (using the same paint) to give uniform and practical ratings when used as a basis of acceptance between consumer and manufacturer.

The original tests on bleeding of traffic paints, carried out by the Michigan State Highway Department for the committee, are more applicable to the method under discussion than to Method D 868, even though the work preceded the adoption of the latter. These tests, based on 10 types of traffic paints of standard use, were made on (1) a laboratory and (2) a road test basis. The laboratory tests were made on specially molded blocks composed of various grades of bituminous road surfacing mixes. These mixes were made with:

1. 85 penetration asphalt cement,
2. T-6 tar (grade RT-6), and
3. SC-3 slow curing road oil.

It was necessary to lower the bitumens content of mixes 2 and 3 because of the fluidity of these materials.

The mixes were molded into 4 by 8-in. slabs of 1 in. thickness and cured for three weeks in the laboratory, one week of which was exposure to the light cycle of a weatherometer.

Each of the ten paints was then sprayed on all types of molded panels and allowed to dry for 24 hr., after which they were exposed to the weatherometer light arc for 8 hr. before being evaluated for bleeding.

In order to correlate with actual road tests the same paints were applied by brush to the following types of surfaced roads:

1. Street, tar road mix and seal coat, tar T-6,
2. Street, concrete pavement, with tar seal coat T-9,
3. Street, plant mix oil aggregate SC-3 (slow curing road oil),
4. Street, plant mix bituminous concrete, 85 penetration asphalt cement, and
5. Street, concrete pavement RC-4 cutback asphalt seal coat.

Atmospheric temperature at the time of application was 85 to 90 F.; pavement temperature approximately 130 to 140 F.

Observations on degree of bleeding were made at the end of four days.

Comparison of the bleed ratings of the paints applied to the laboratory molded slabs and the actual road paint-outs are shown in Table I. It is to be remembered that the present set of pictorial standards of D 868 had not as yet been developed, although the comparative rating system that was used by the Michigan Highway Department is quite similar to the above standard.

Comment at time of completion of these tests in 1943 was that "results were not too conclusive" due to the difference in the action of these paints on the various types of pavements. The tests did show, however, that *tar seal coats* represent the road surface which promotes the most severe bleeding. These data, it is to be recalled, were compiled during the

[4] 1946 Book of A.S.T.M. Standards, Part II, p. 1581.

TABLE I.—COMPARATIVE LABORATORY AND FIELD BLEEDING TESTS ON TRAFFIC MARKING PAINTS.

Rating 10 = No discernible bleeding or color change.
Rating 8 = Very slight bleeding or color change (barely noticeable).
Rating 6 = Slight bleeding or color change.
Rating 4 = Distinct bleeding or color change (cream tint).
Rating 2 = Considerable bleeding or color change (light tan or buff tint).
Rating 0 = Severe bleeding or color change (deep orange to brown color).

Paint Identification	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Laboratory mix, Tar T-6	2	6	6	4	6	8	8	4	8	8
Street, tar road mix and seal coat, Tar T-6	0	8	6	2	2	4	4	4	6	4
Street, concrete pavement, with tar seal coat, Tar T-9	0	8	8	4	4	2	2	4	4	2
Laboratory mix, SC-3 slow curing road oil	2	10	8	6	6	8	8	6	8	6
Street, plant mix oil aggregate SC-3, slow curing road oil	8	10	10	10	10	10	10	10	10	8
Laboratory mix, 85 penetration asphalt cement	8	10	10	10	10	10	8	8	10	10
Street-plant mix bituminous concrete, 85 penetration asphalt cement	8	10	10	10	10	[a]	8	10	10	8
Street-concrete pavement, RC-4 cutback asphalt seal coat	8	10	10	10	8	[a]	10	10	10	8

[a] Not sufficient sample for test.

initial efforts to set up bleeding standards.

In view of more extensive data on laboratory tests which have been compiled since the 1943 tests were made, it is believed that a variation of not more than 2 in the bleed ratings at the lower end of the scale on similar types of roads using the same paint can be considered good correlation and close enough for practical purposes.

The lesser bleeding of asphalt as compared to tar has also been confirmed, without a doubt, and the closer readings within this group in Table I are attributed to the reduced bleeding tendency of the former.

From 1943 to 1946 there was considerable activity directed toward obtaining satisfactory pictorial standards for Method D 868. This was worked out by using a coal-tar paper base. Variation in the degree of bleeding was obtained by choosing various standard paints that gave the desired graduated differences in bleeding. The main purpose was to obtain good visual comparisons in photographic reproduction that would depict degrees of discoloration from very slight to severe. Reproduction of these standards are those shown in A.S.T.M. Method D 868.

The good results obtained with 15-lb. coal-tar saturated felt in devising Method D 868 influenced us to continue with this medium in our efforts to accomplish objective No. 2, that is, laboratory method of testing traffic paints for bleed resistance. Moreover, it met the simplicity of usage and procurement, mentioned earlier as one of the prime requisites of the test apparatus. However, additional data had to be obtained as described in the following outline:

1. Further investigation of the uniformity of bleed from tar paper:
   (*a*) Best type of felt saturant (asphalt or coal tar).
   (*b*) Best type of felt base.
   (*c*) Effect, if any, of age of tar paper on amount of bleeding or on uniformity.
   (*d*) Establishment of specifications for tarred felt finally selected in order to assure an easy and uniform source of supply for those who would use the test.
   (*e*) To determine whether A.S.T.M. Specification D 227[5] (for coal tar saturated felt) might be used.
2. To observe the effect of film thickness on bleeding and the optimum film thickness for test.
3. To study the effect of method of application on bleeding.
4. To determine the effect of temperature on bleeding.
5. To establish the optimum drying period necessary to develop the full amount of bleed.

While cooperative tests along the above lines were proceeding with the tarred felt, two alternate methods were also being investigated, both of which were designed to replace the tarred felt variable by means of bleeding substrata which could be made up in liquid form—controlled for bleeding uniformity—and applied by means of an applicator to yield a uniform dry film thickness. These bleeding compositions were:

1. Liquid tar of definite specification carried in a solution of either ethyl cellulose or ester gum.
2. Oil-soluble dye solutions in either of the above media, which would bleed through with an intensity and color similar to tar.

The above two methods were thought necessary in the face of opinions by leading manufacturers of roofing papers that the tar-saturated felt could not be supplied to yield uniform bleeding intensity—even from the same plant of a single manufacturer. Results of these two methods will be discussed later.

In the investigations of the tarred felt specimen panels, the following discussion and conclusions are listed in numerical sequence as outlined previously in this article under objective No. 2.

1 (*a*). Tar-saturated felt bleeds more severely than asphalt type as illustrated in Fig. 1. Paint used in each of the above tests is a standard alkyd traffic type with mineral spirits as the volatile portion. In Fig. 1, panel *A* (coal tar) would rate about 4 and panel *B* (asphalt) would rate 9 according to Method D 868. Thus asphalt was eliminated as a testing medium since it is not sensitive enough to give the proper range in bleeding intensity.

(*b*). Various investigators had found little significant difference in the comparative bleeding intensity of 15-lb. rag *versus* 15-lb. asbestos felt—both coal tar saturated—with type of paint and film thickness constant.

(*c*). It was found that bleeding intensity was not affected by the location in the roll from which the specimen panel was taken. Neither did the age of the tarred felt have any noticeable effect. While it is recognized that a certain amount of oxidation of the saturant occurs upon storage, this reaction apparently has no effect upon the soluble portions of the coal tar that bleed. Figure 2 shows two panels, *B* and *C*, taken from a freshly opened roll of tarred felt and one panel, *A*, from felt that was at least 2 yr. old. Specimen panels *B* and *C* are taken from the outer edge and inner portions of the roll as well as from inner and outer convolutions. Bleeding intensities are relatively equal.

(*d* & *e*): A.S.T.M. Specifications D 227[5] deals more with the physical properties of the finished paper than with the grade of saturant used. The saturant is the determining factor in the degree of bleeding and it was decided, therefore, not to specify that the paper conform to A.S.T.M. Specifications D 227.

2. Rate of bleeding intensity varies inversely as the thickness of the paint film, provided the substratum is not disturbed during application. However, at the end of 24 hr. drying time there is no practical difference in the intensity of the discoloration where films were applied from 0.003, 0.005, 0.008, and 0.03-in. clearance applicators.

3. Disturbance of the substrate increases the intensity of bleeding but also interferes with uniformity. Therefore, doctor blade application was chosen as standard.

4. All bleeding tests were conducted at 77 F. and relative humidity of 50 to 55 wherever possible; otherwise at room temperature. However, it was first determined that when the specimen panel was placed in an oven, maintained up to 150 F. for 48 hr. immediately following application of the paint, the intensity of the bleed was no greater than when the panel was kept at room temperature. However, the *rate* of bleeding was much more rapid at elevated temperatures. In other words, after a few hours the panels at elevated temperatures showed maximum bleeding whereas those at room temperature required 24 hr. to reach the same intensity of bleed.

5. Although most of the bleeding occurs within 24 hr. after application, 48 hr. drying time before making the bleed ratings was established in order to provide a safety margin.

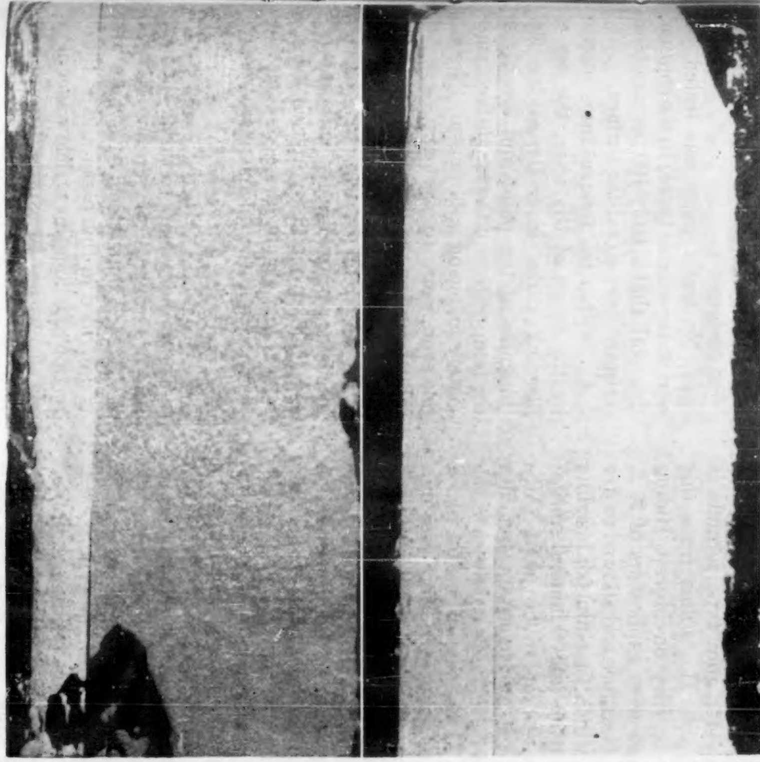
Solvent Influence:

As a point of interest it is important to comment on bleeding as affected by different types of solvents. Results can be generalized as follows:

1. With all other paint factors except viscosity remaining constant,[6] bleeding intensity increased as the total evaporation time of the solvent increased. Thus for coal-tar aromatics, bleeding was the least with toluol, xylol being much worse. The same holds

[5] Standard Specifications for Coal-Tar Saturated Roofing Felt for Use in Waterproofing and Constructing Built-up Roofs (D 227-47), 1947 Supplement to Book of A.S.T.M. Standards, Part II, p. 125.

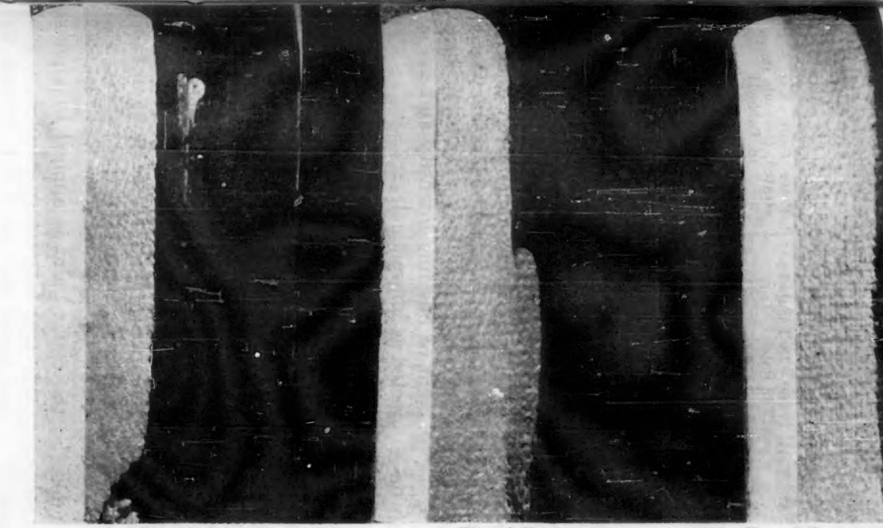
[6] Variation in viscosity is unavoidable with the nonvolatile portion remaining constant.



Panel A—Coal Tar Felt Substrate. Panel B—Asphalt Felt Substrate.

Fig. 1—Bleeding Comparison of Coal Tar and Asphalt Saturated Felt.

Narrow nonbleeding contrast surface at extreme left on each panel provided by paint applied over cellophane tape.

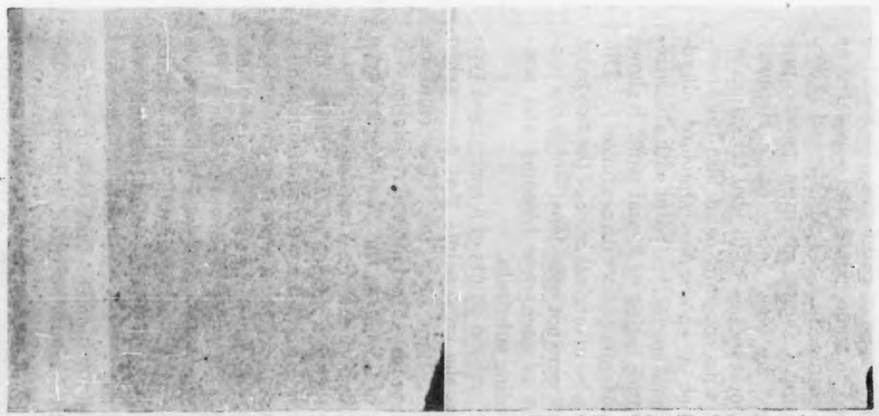


Panel A
Felt aged 2 yr. wrapped in craft paper.

Panel B
Felt from inner convolution of roll aged a few weeks.

Panel C
Felt from outer convolution of roll aged a few weeks.

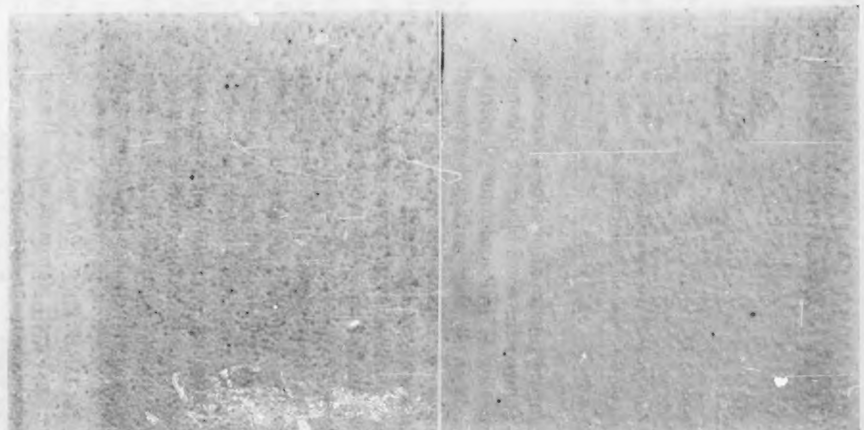
Fig. 2.—Effect of Aging on Bleeding Potential (Coal Tar Felt).



Panel A—Alkyd - Mineral Spirits Type Paint

Panel B—Manilla-Methanol Type Paint

Fig. 3.—15-lb. Coal Tar Felt Substrata.



Panel A—Alkyd - Mineral Spirits Type Paint

Panel B—Manilla-Methanol Type Paint

Fig. 4.—Ester Gum-Coal Tar Substrata.

TABLE II.—FORMULA FOR COAL-TAR SOLUTION USED FOR APPLYING BLEEDING SUBSTRATA UPON WHICH TO DETERMINE THE DEGREE OF RESISTANCE OF TRAFFIC PAINTS TO BLEEDING.

	Solution Composition		Solids Composition	
	Parts by Weight	per cent	Parts by Weight	per cent
Ester gum	1367.0	51.3	1367	66⅔
Xylol	615.0	23.1	...	...
Total ester gum 69 per cent solution	1982.0	74.4	...	...
Coal-tar liquid (Federal Specification RT-4)	683.0	25.6	683	33⅓
Total solution	2665.0	100.0	2050	100

TABLE III.—LABORATORY TESTS ON RESISTANCE TO BLEEDING SHOWING RESULTS OF COOPERATING LABORATORIES USING METHOD D 969 – 48 T[3] (TAR PAPER SUBSTRATE) *VERSUS* SUBSTRATE PREPARED FROM ESTER GUM - COAL - TAR LIQUID.

Bleeding Resistance Rated According to A.S.T.M. D 868 – 48.[a]

Cooperating Laboratory	A.S.T.M. D 969 – 48 T Substrate (Tar Paper)				Ester Gum - Tar Substrate[a], (formula shown in Table II)	
	Alkyd Paint[b]		Manila Paint[b]		Alkyd Paint	Manila Paint
	1 and 2	3 and 4	1 and 2	3 and 4		
No. 1	3, 3	3, 3	7, 7	7, 7	5, 5, 5	8, 8, 8
No. 2	4, 4	4,4	10, 10	10, 10	...	...
No. 3	4, 4	3, 3	7, 7	7, 7	4, 4, 4	7, 7, 7
No. 4	...	3, 3	5, 5	...	3, 3, 3	7, 7, 7

[a] Duplicate panels at 24 hr., 48 hr., and 72 hr., drying time of ester gum-tar solution film using 8 mil clearance applicator.

[b] 1 and 2 refer to paint applied to duplicate panels from freshly opened roll of coal tar felt. 3 and 4 are duplicate panels from same roll aged 2 weeks prior to application of joint.

true for petroleum aliphatics where troluoil showed the least bleeding followed in order by VM&P and mineral spirits.

2. With all other paint factors except viscosity remaining constant[6], including relative evaporation rate, bleeding increases as the solvent power increases so that aromatics cause worse bleeding than aliphatics in similar evaporation ranges.

So far the discussion and illustrations have been confined to the use of the tarred felt test involving films applied from traffic paint that bleeds noticeably. The so-called nonbleeding or bleed-resistant paints of the spirit or alcohol-soluble variety were also studied. Such a paint was made using the following vehicle composition by weight: 80 parts Manila DBB Gum, 20 parts No. 15 blown castoroil, 100 parts of methanol.

Methanol was used in order to avoid the solubilizing effect of hydrocarbon and other solvents that are employed in denatured ethyl alcohols.

This type of paint was also found to bleed to some extent and was rated as 7 according to A.S.T.M. Method D 868. Figure 3 shows specimen panels prepared by New Jersey State Highway Laboratories on 15-lb. coal tar saturated felt with constant paint film thickness. Panel A shows the standard alkyd-mineral spirits type paint with a bleed resistance rating of 3, and panel B shows the Manila paint with a rating of 7. Differences in original color of the two paint films were not considered—only the contrast of each over bleeding and nonbleeding substrata.

Emulsion paints of a specialized type were the only paints that approached nonbleeding over tar. The emulsion paints tested had a bleed resistance rating of 9 whereas the Manila-spirit type shows noticeably less resistance to bleeding, with a rating of 7. During the phase of the work with emulsion paints, it was proved that a paint made from the water phase of the emulsion also caused slight bleeding. However, when the emulsifying agents were omitted from the same water-soluble film-forming components, the resultant paint film was entirely bleed resistant. This would seem to indicate that certain surface-active agents solvated portions of the tar substrate. A paint made with a water-soluble binder as the vehicle could not be considered practical due to complete lack of water resistance, so the above data are given as of academic interest only.

Since the members of the group decided that the cooperative tests using tarred felt specimen panels were satisfactory, the two alternate methods mentioned above are being held in abeyance for possible future use. The results of the tests using these methods are considered of sufficient interest, however, for presentation in this article.

The first type of special bleeding substratum solution was prepared by mixing liquid road tar - RT-4 (which can be obtained from any coal-tar products manufacturer) with (1) ethyl cellulose solution and (2) with an ester gum solution. However, since the ester gum is cheaper and more readily available, plus the fact that more uniform bleeding was obtained than with the ethyl cellulose - coal tar films, all cooperative work was carried out with the ester gum - coal tar base. The ester gum type formula is shown in Table II. Films from this solution were cast on Morest Hiding Power Charts with applicators of 3, 5, and 8 mils. clearance and allowed to dry 45 min. at which time films of bleeding type traffic paint (alkyd mineral spirits) and bleed-resistant traffic paint (Manila) were cast at a constant wet film thickness of $2\frac{1}{2}$ to 3 mils crosswise of the tar films. At the end of the 24 hr., a second set of paint films were cast in a like manner and each set of films judged for bleeding at the end of 48 hr. according to A.S.T.M. Method D 868 The ratings showed good correlation with the tarred felt specimen panel tests as shown in Table III.

Figure 4 shows results of ester gum-coal tar substrata tests which may be compared with the 15-lb. tarred felt panels in Figure 3. The paints used are the same as discussed previously: (1) the alkyd control for bleeding, and (2) the bleed-resistant Manila type.

Another test was tried in a limited way—oil-soluble dye Brown "M" carried in the same ester gum and ethyl cellulose solutions. Bleeding results were quite good but the color tone of the bleed was so much more red than the characteristic tar discoloration that it was considered likely to cause misjudgment of bleeding intensity and was rejected as impractical.

Summarizing, it has been shown that:

1. A simple and practical laboratory "method of test for evaluation of resistance of traffic paint to bleeding" has been developed which appears to illustrate the bleeding potential of various types of traffic paints.

(*a*) This method, published as A.S.T.M. Method D 969 – 48 T,[3] is based on the application of traffic paint to 15-lb. coal tar saturated felt (tar paper).

(*b*) An alternate method, whereby the traffic paint is applied to a previously cast film composed of ester gum and liquid coal tar RT-4, wherein the latter produces the bleeding, has indications of being equal in practical results and more "fool proof" in bleeding control.

2. Coal tar - surfaced roads bleed much more severely than do asphaltic or oiled surfaces.

3. No traffic paint was tested (except water-soluble types) in the course of this work that is truly 100 per cent bleed resistant over a coal-tar surface.

4. Within the temperatures covered by the scope of the tests, the *rate* of bleeding varies inversely as the film thickness of the paint and directly as the temperature of the tar surface immediately following application. Neither, however, seems to exert any significant influence over the final intensity of the bleed.

5. As would be expected, bleeding intensity varies directly with the percentage of aromatic hydrocarbon in the solvent and also decreases as the evaporation rate of the solvent increases.

Acknowledgment:

The author wishes to thank the members of Group IV of Subcommittee IV, A.S.T.M. Committee D-1, whose work is described in this paper and at the direction of whom this article was written. He also wishes to express his appreciation for the photographs which were made through the courtesy of Mr. H. Jerome Long of Maplewood, N. J.

Electrical Method for Evaluation of Protective Coatings as Moisture Barriers

By Marion A. Arthur[1]

SYNOPSIS

Tests of waterproofing materials for various electrical parts were completed in a matter of weeks by measuring resistance changes of coated insulators during immersion cycles.

OUR laboratory had at one time only a few weeks available in which to get relative ratings of all waterproofing materials which conceivably might protect various electrical items. Therefore, it was decided to use the change in electrical resistance of a bakelite substrate as the detector for the effectiveness of various coatings as moisture barriers. Electrical methods of investigating insulating materials are in the minority in the plastics literature, but pertinent references found later are (**1, 5, 12, 15, 17**).[2] The method described below differs from these in having both a nonconducting substrate and a nonconducting coating.

Material.—Each test strip was of XX bakelite, 5 by $\frac{1}{2}$ by $\frac{1}{16}$ in. Each strip was fitted with one pair of silver plated turret lugs spaced $\frac{5}{16}$ in. apart. All edges were left intentionally sharp, as cut (**8**). The test solution was 5 per cent NaCl. Resistance measurements of each strip were made on a General Radio Megohm Bridge, having a maximum range of 10^{12} ohms.

Procedure.—The uncoated bakelite strips were baked (dried) for 1 hr. at 150 C. Three or more were dipped in each test coating and air-dried or baked, as noted. The resistance before immersion in NaCl solution was found to be greater than 10^{12} ohms in all cases.

Three systems of exposure were used. In the first, the immersion period of 24 hr. was alternated with an equal drying period. In the second, the strips were continuously immersed for one week and then suspended permanently $\frac{1}{16}$ in. above the surface of the salt solution. This put the electrical connections 1 in. above the solution (**8**). In the third, all test strips were in a high humidity box continuously at 99 per cent relative humidity and 95 F. Resistance readings taken continuously during all tests showed steady degradation, fastest in the hotbox and slowest in the alternating immersion method. In addition, data were also taken for 1, 2, and 3 coats in the paint, varnish, and lacquer group. All wax types were single coats only.

All three methods oı immersion gave substantially the same relative rating for each test coating, whether it was put on in 1, 2, or 3 coats. This consistency is one measure of the worth of such a system (**17**) for evaluating the life of protective coatings. It was found that connection to the turret lugs could be made without harm by breaking the coatings at their tips. There was no increase in degradation of the bakelite due to this break, for duplicate pairs of lugs were installed and the same readings were obtained with both pairs, whether covered or exposed.

Results.—Materials tested are listed by class rather than by trade name. All resistances listed are 10^9 ohms, and all strips started at or above 10^{12} ohms.

	Resistance After Immersion			Thickness, mils, Approx.
	1 week	3 weeks	5 weeks	
No. 1 Asphalt-like wax (Dip at 175 C.)[a].	1000	1000	1000	35
No. 2 Plating stopoff compound (Dip at at 150 C.)[b]	1000	1000	1000	20
No. 3 Wax blend I (Dip at 215 C.)	467	178	98.3	22
No. 4 Phenolic paint + lacquer (Air-dry)	141	29.5	16.0	2.5
No. 5 Wax blend III (Dip at 210 C.)	28	15.8	10.3	22
No. 6 Phenolic paint only (Air-dry)	24	10.6	6.7	2.0
No. 7 Alkyd paint (Air-dry)	103	12.0	6.5	2.0
No. 8 Wax blend IV (Dip at 240 C.)	22	9.6	6.4	20.0
No. 9 Wood varnish I (Baked at 65 C.)	25	6.3	4.9	1.5
No. 10 Wurtzilite (Air-dry)	92	6.3	1.0	3.0
No. 11 Vinyl I (Air-dry)	217	5.8	...	1.0
No. 12 Vinyl II (Air-dry)	95	5.2	...	1.0
No. 13 Mica-filled resin (Air-dry)	15	3.8	...	1.5
No. 14 Wood varnish I (Air-dry)	83	3.1	...	1.5
No. 15 Vinyl III (Air-dry)	103	2.7	...	1.5
No. 16 No coating (Baked strip at 140 C.)	0.11	0.04	0.005	nil

[a] Mitchell-Rand Insulation Co.'s Rubberseal No. 3. At 8 wk. its resistance was 800×10^9 ohms.
[b] United Chromium, Inc.'s Electroplating Stopoff Compound No. 311. At 8 wk. its resistance was 470×10^9 ohms.

Discussion.—Throughout the paint evaluation literature (**3, 10, 11, 14**), the general tone with regard to accelerated tests is that they are at best doubtful as indicators of ultimate life (**7, 8, 9**). This is definitely *not* an accelerated test. The strips in question may be subjected to any desired environment and the usual visual or photographic evaluations may still be made. What is described is a sensitive method of detecting failure (not ultimate rank) sooner than by any other method, and by this is meant "failure to protect" without reference to any concurrent disintegration, decomposition, or degradation of the film. The "failure to protect" is the all-important criterion in coating our metallic and ou electrical parts.

As an example, six of the coatings tabulated above were simultaneously tested in 5 per cent NaCl solution after application to strips of No. 28 gage black iron, $\frac{1}{2}$ in. wide by 6 in. long. These coatings were Nos. 4, 7, 10, 13, 14, 15, respectively. One month later the rusted areas on each strip were measured and the same coatings were ranked 1, 2, 3, 4, 6, 5, respectively.

The point has been raised as to whether the test indicates the value of the coating as a protective moisture carrier or whether the film itself absorbs moisture and provides an electrical path for increased conductance. This is a very fine point, indeed, and I feel that the film is a failure in either case, because surely the substrate is subject to corrosion if the film is permeable.

With regard to the effect of drying, not enough complete cycling was done to appraise any changes in film integrity due to drying. However, films Nos. 6 and 7 were both baked after immersion in NaCl and returned to 0.5×10^{12} ohms and to 10^{12} ohms, respectively. After re-immersion in NaCl the rate of drop in resistance was very slightly less than before. The improvement is thought to be due to further polymerization within each film due to baking.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 1916 Race St., Philadelphia 3, Pa.

[1] Humble Oil and Refining Co., Houston, Tex.
[2] The boldface numbers in parenthesis refer to the list of references appended to this paper.

For the single characteristic of permeability (**16**), our electrical resistance measurements have quickly and easily picked out the useful coatings, namely, Nos. 1 and 2, above. Both have served perfectly in field use, No. 1 for 12 yr. and No. 2 for 2 yr. To quote Compton and Phair (**14**), "Two general procedures may be followed in establishing the corrosion protection afforded by organic finish systems.... The second procedure consists in making measurements of the physical properties of the organic coatings at periodic intervals during exposure and in estimating the amount of expected protection from the rates of degradation.... Selection of the tests depends in large measure on the proposed usage of the finish system.... Associated with these tests, initial measurements of moisture permeability of the film and of the electrochemical behavior as influenced by pigmentation are valuable in determining the probable protective level." The electrical resistance method described herein is, therefore, recommended for such determinations.

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Creep and Relaxation in Compressed Asbestos Gaskets[1]

By F. C. Thorn[2]

Gaskets cut from compressed asbestos sheet are used to pack a very large percentage of all bolted flange joints operating in the temperature range from 212 F. to 500 F. They have effectively replaced nonfibrous rubber gaskets over the greater part of this range. It is reasonable to assume, therefore, that they possess qualifications peculiarly adapting them to this application. The basic qualification must be the ability to exert a continuing unit load against the confining flanges, since any gasket will fail if this load drops below the pressure of the contained fluid.

It is surprising, therefore, that no prior attempt appears to have been made to evaluate compressed asbestos in terms of this basic property. Instead, we find purchase specifications replete with such requirements as chemi-

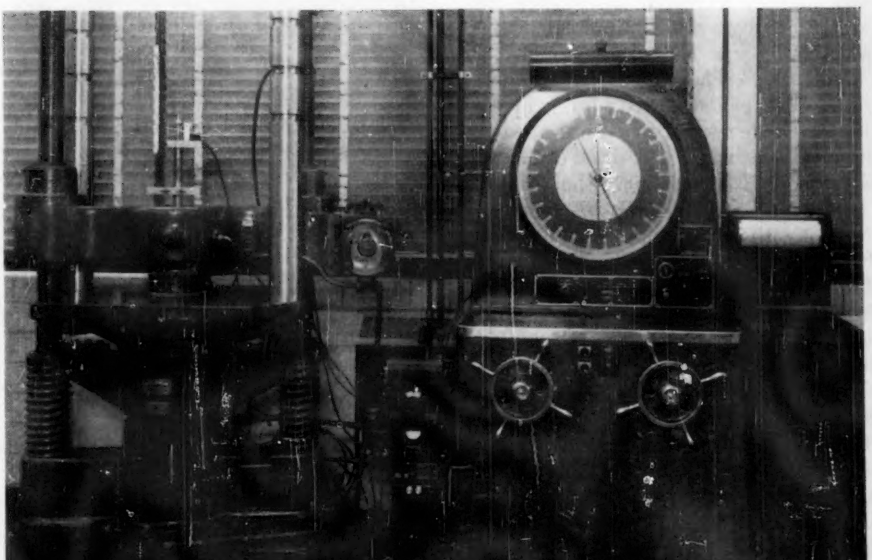

Fig. 1.—Test Machine.

Note.—Discussion of this paper is invited, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 1916 Race St., Philadelphia 3, Pa.

[1] Paper read before the meeting of Subcommittee VI on Packings of A.S.T.M. Committee D-11 on Rubber and Rubber-like Materials, March 3, 1949.

[2] Research Director, The Garlock Packing Co., Palmyra, N. Y.

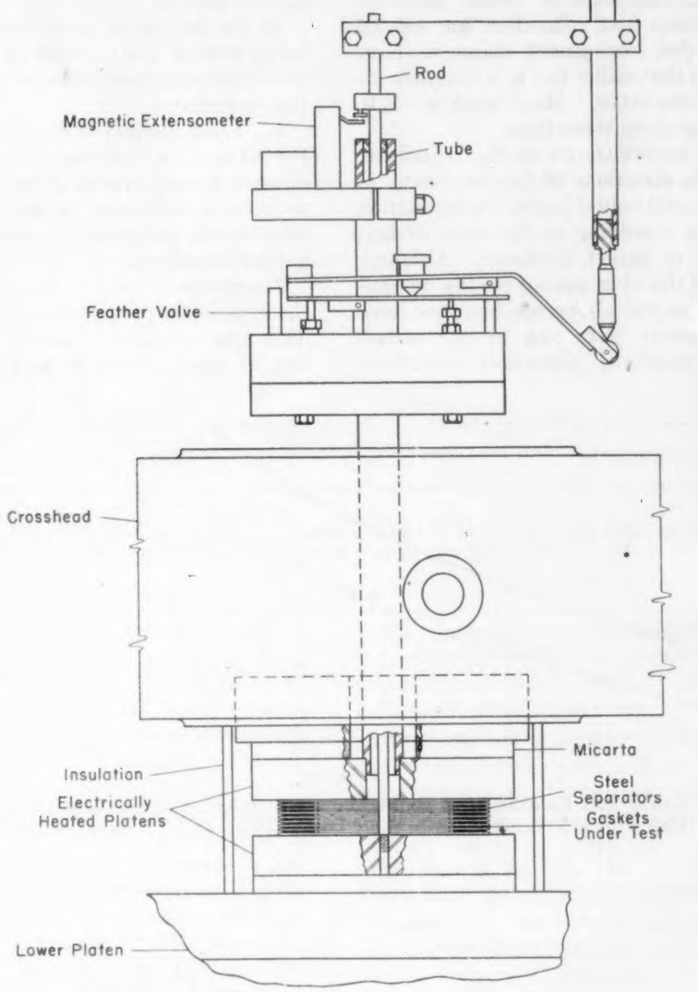

Fig. 2.—Apparatus for Creep and Relaxation Tests.

cal composition, ignition loss, tensile strength, flexibility, together with permitted changes in these properties and in thickness, as a result of immersion in water, steam, air, oil, etc., for various times and temperatures. Now, in the case of immersion tests, it is apparent that these must have, at the most, a remote connection with service in which merely the thin edge of the gasket is exposed to these various media, and in the case of the other requirements, no satisfactory correlations with service have ever been demonstrated.

Structural members of other materials, such as steel tie-rods, beams, and bolts, are often required to support loads over long periods at elevated temperatures, and the desired property has been evaluated by creep or relaxation tests. Creep tests measure the change in strain resulting from the application of a constant stress. Relaxation tests measure the change in stress at constant strain. The deterioration of a gasket under compression, however, is seldom a matter of either pure creep or pure relaxation, it is rather a mixture of the two. It may be described as creep under a progressively diminishing load, as the bolts shorten, or may be otherwise described as relaxation partly offset by constantly increasing strain. To describe this hybrid type of deterioration, the author has previously employed the term "stress decay"[3] and described a machine for measuring it[4] which consists essentially of a bolted flange joint with calibrated bolts and refinements to permit the continuous and accurate recording of bolt extension during the test. It is apparent, however, that the readings given by this machine, although valuable, are valid only for the particular ratio of bolt extension to gasket thickness which is built into it, and directly applicable only to those bolted flange joints in which a similar ratio exists. The need was felt for measuring creep and relaxation separately, without complicating one by the other.

The machine employed for these tests is shown in Fig. 1. It is a standard 60-ton Baldwin Southwark testing machine with certain special attachments. These consist of:

1. A pair of electrically heated platens (Fig. 2) between which the gaskets are held. A magnetic strain gage attached to a rod-and-tube extensometer connects with the autographic recorder on the machine, which serves as an index of strain. To magnify results it has been our practice to test eight super-

[3] A more scientific term would be "creep-relaxation."

[4] F. C. Thorn, "Compression and Stress-Decay in Rubber Gaskets," ASTM Bulletin, No. 112, October, 1941, p. 13.

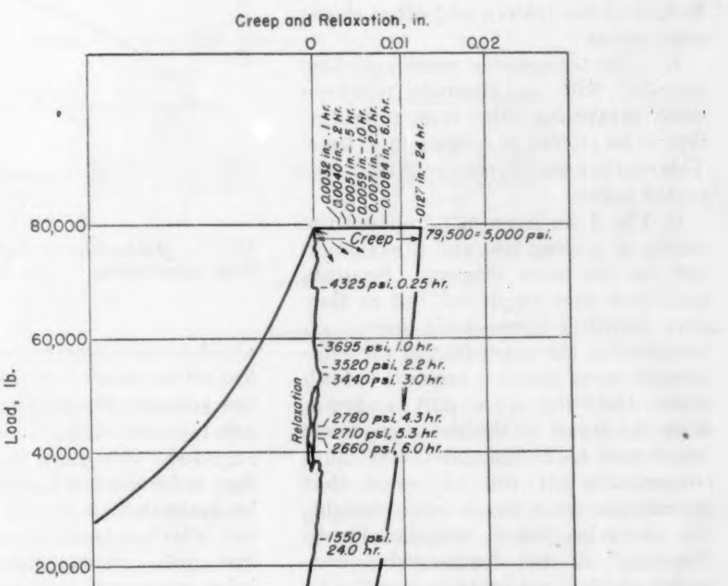

Fig. 3.—Creep and Relaxation of Eight Compressed Asbestos Gaskets 4¼ by 6$\frac{3}{16}$ by $\frac{1}{16}$ in. Thick with Intervening $\frac{1}{16}$-in. Steel Disks (24 hr. at 212 F.).

imposed $\frac{1}{16}$-in. gaskets with $\frac{1}{16}$-in. steel separators alternating, as shown. These separators can be given any kind of finish, but in our tests to date they have been given merely a commercial finish on a surface grinder. Although the temperature controller bulb is located within the platen, explorations of the space within the gaskets and of the gaskets themselves by a thermocouple indicate that substantially uniform temperatures prevail. It is important in this connection that the heating elements be not directly beneath the specimen, that the voltage be regulated so that the current is on most of the time, and that the outside be heavily jacketed. It has been our practice to precondition specimens for about an hour at a load corresponding merely to the weight of the upper platen before applying the test load. Some error in reading the strain undoubtedly arises from the fact that the rod and tube are not at the same temperature over their entire length, but inasmuch as each test has been conducted at a single temperature, it has been assumed that the zero adjustment, once established, would not vary.

2. A stress holder for conducting creep tests.

3. A strain holder for conducting relaxation tests. This operates through a feather-valve controller mounted on the rod-and-tube directly below the strain gage and serves to unload the specimen as necessary to maintain uniform thickness. It is necessary that the feather-valve controller be controlled by the specimen thickness, and not by platen separation, since in the latter case the operation is vitiated by varying deflection of the platens and other elastic components.

4. The autographic recorder is also provided with an alternate telechron drive, permitting either creep or relaxation to be plotted as a function of time. This was not used in the experiments reported below.

In Fig. 3 we have superimposed the results of a creep test and a relaxation test on the same diagram. Separate specimens were employed, but as they gave identical stress-strain curves on compression the upper part of the compression curve shown is common to both tests. Only the upper part is shown, since the travel of the strain gage was insufficient to accommodate the total compression. It will be noted that whereas the creep line is quite straight, the relaxation line is irregular due to "hunting" of the feather-valve controller which is not quite as sensitive as we should like to have it. Both lines are marked with time intervals, and these have been plotted on semi-log paper in Fig. 4, indicating that both creep and relaxation are roughly logarithmic functions of time within the limits shown. Although it seems probable that creep and relaxation are related properties, we cannot claim to have proved that either one is a complete index of the other. Much work needs to be done along these lines.

The arrows shown in Fig. 3 indicate possible directions of "stress-decay" in commercial bolted joints, the inclination varying according to the ratio of bolt stretch to gasket thickness. Although tests of this type cannot readily be conducted in the above machine, we have independent tests run in our stress-decay machine, previously described, which indicate that loss of stress is much less severe where bolt stretch is present, the severity diminishing as the creep axis is approached. This is as would be expected. We also have indications that restoration of load at the end of 24 hr. inaugurates a second cycle of relaxation which is much less severe than the first cycle. Since retightening a bolted joint, not merely once but several times during the first 24 hr. of operation, is considered good commercial practice, significant results might be obtained by running, first a 24-hr. creep, and then a 24-hr. relaxation test on the same specimen. We have no results along these lines to report.

In the interest of more closely simulating service it is possible to introduce two other variations into the relaxation test procedure;

1. Load applied before the heat is turned on. In that case the immediate effect is a rapid relaxation in stress due to thermal softening of the specimen, after which relaxation proceeds at the normal logarithmic rate.

2. Sample cooled in the machine at the conclusion of the relaxation period. This approximates service on a steam line in which there is a downstream valve, the line filling up with condensate at full pressure when the valve is closed. This is particularly severe because it superimposes the effect of thermal contraction on the relaxation which has already occurred.

An attempt to determine "cold-to-cold" relaxation under the conditions of Fig. 3 resulted in no measurable residual load at the conclusion of the test. The same, repeated at a lower temperature (158 F.), is shown in Fig. 5. The final increase in relaxation (from 74 per cent to 90 per cent) is the result of thermal contraction.

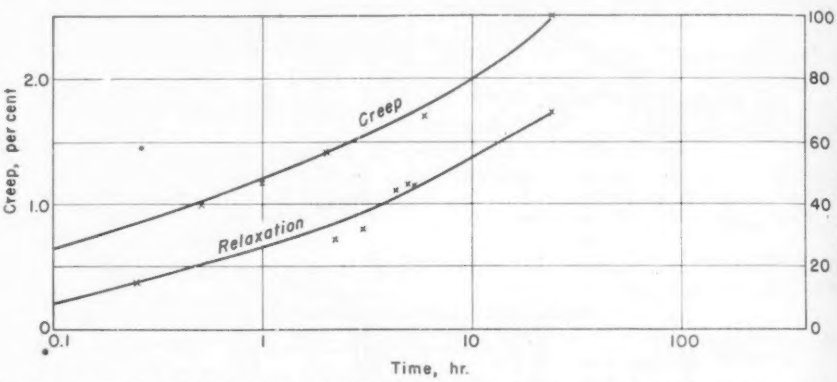

Fig. 4.—Creep and Relaxation of Eight Compressed Asbestos Gaskets 4¼ by 6$\frac{3}{16}$, by $\frac{1}{16}$ in. Thick with Intervening $\frac{1}{16}$-in. Steel Disks (24 hr. at 212 F. and 5000 psi.).

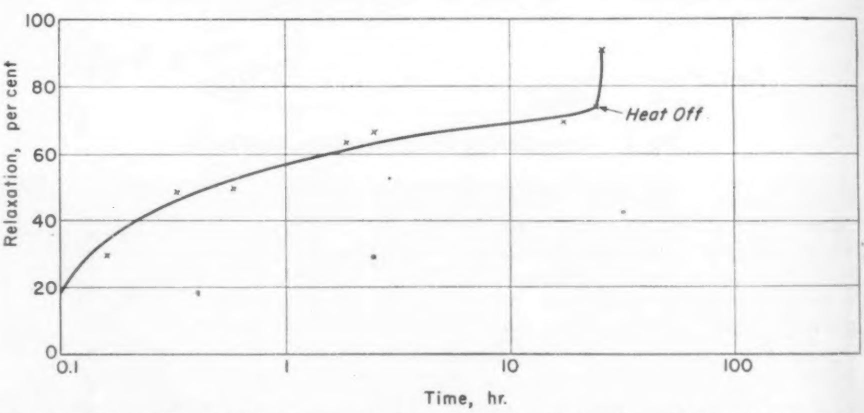

Fig. 5.—Relaxation of Eight Compressed Asbestos Gaskets 4¼ by 6$\frac{3}{16}$ by $\frac{1}{16}$ in. Thick with Intervening $\frac{1}{16}$-in. Steel Disks Starting and Ending at Room Temperature (24 hr. at 158 F.).

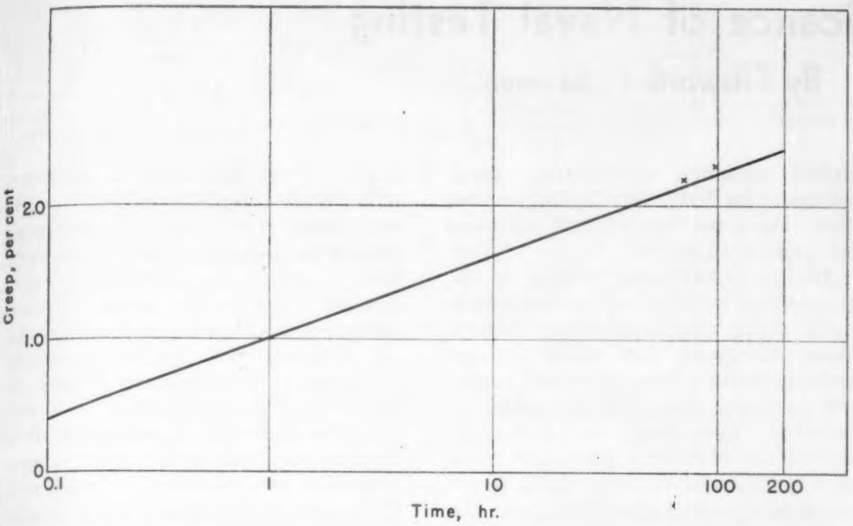

Fig. 6.—Creep of Eight Compressed Asbestos Disks $1\frac{1}{8}$ by $\frac{1}{16}$ in. with Intervening $\frac{1}{16}$-in. Steel Disks (198 hr. at 212 F. and 2000 psi.).

On Fig. 3 we have also shown the retraction curves at the end of the creep and relaxation periods. It will be noted that they are quite steep, and the recovery is only a small fraction of the original compression. We do not attach any importance to recovery as an index of gasket quality, but the slope of the retraction curve at the beginning is of commercial significance, because in conjunction with the elastic modulus of the bolts it determines the extent to which the gasket is unloaded if fluid pressure is introduced into the joint at the end of the creep (or relaxation) period.

To date most of our work with this machine has been done with creep testing. In Table I we show a few creep figures for varying conditions of temperature and load. It will be noted that:

1. Creep increases with temperature as would be expected.

2. At any temperature creep is higher at 2000-psi. loading than at 5000-psi. loading. This result, which is contrary to results obtained with other materials, is probably explained by the fact that compression, in asbestos gaskets, is basically a collapse of a porous structure, and, in the case of heavy initial loadings, the structure is largely collapsed, leaving less room for creep thereafter.

The last finding leads to an important corollary, namely, that best results with compressed asbestos gaskets are obtained at high initial loadings, short of the actual crushing strength of the gasket. It is realized, however, that equipment builders are reluctant to construct flanges for loads of 5000 psi. or higher when the fluid pressures are of the order of only a few hundred psi. Another corollary is that creep probably does not follow a logarithmic pattern indefinitely but eventually stops or proceeds at a much reduced rate. Much work needs to be done along these lines.

It is realized that the machine described is primarily a research tool and is too expensive for the routine evaluation of various types and shipments of compressed asbestos sheet. A cheaper apparatus is needed. In the case of creep tests, this is readily supplied. In our laboratory we have an air-operated arbor press which has been used for the single purpose of measuring creep at 2000 psi. and 212 F. The load is determined by a regulator on the air-line, ignoring packing friction in the air-cylinder. Platens are heated by steam, and strain is measured by twin dial micrometers. The specimen is composed of superimposed disks $1\frac{1}{8}$ in. in diameter (approximately 1 sq. in. in area) with steel separators. Results have been found to check the larger machine closely. We show (Fig. 6) a plot of creep up to 8 days—it will be noted that it is still proceeding logarithmically.

If it should develop that creep and

TABLE I.—CREEP IN PER CENT IN 24 HR. FOR VARIOUS TEMPERATURE AND LOAD CONDITIONS.

	500-psi. Load	2000-psi. Load	5000-psi. Load
70 F.	1.6	2.2	1.4
212 F.	2.6	3.2	2.4
400 F.	3.7	4.1	2.6

relaxation are merely phases of a single property, the simple creep method above described will do for both. If, however, an independent method for relaxation is needed we have devised one which requires the use of the heavy machine but does not require the special attachments, and does not tie the machine up for long periods. It measures the relaxation "cold to cold" which, as noted above, gives a higher value than the relaxation at service temperature. Four stacks of $1\frac{1}{8}$-in. disks with steel separators are compressed cold between plates shown in Fig. 7, and at the instant the desired load is obtained the central wedge bar is adjusted to put a stop to any further compression. The jig is then bolted shut, removed from the test machine, heated in an oven for any desired temperature and time, cooled, restored to the machine, loaded, unbolted, and the load slowly backed off. An attempt is made to read the load at the instant contact is lost between the plates and wedge bar. This instant can best be detected by maintaining thumb pressure on the wedge bar; when contact is lost, it slides. Two successive tests at 5000 psi. initial load, 24 hr. aging at 158 F., gave cold residual loads

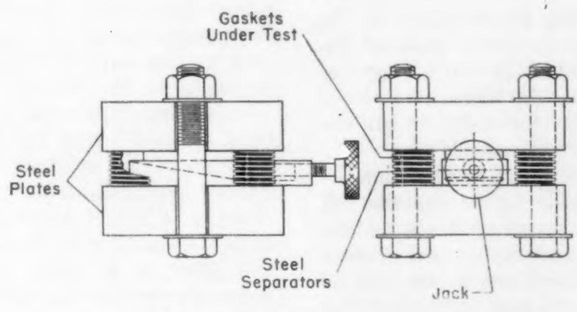

Fig. 7.—Jig for Relaxation Tests.

of 587 and 575 psi., respectively, which check fairly well with the value (505 psi.) shown in Fig. 5. Much more work, however, needs to be done with this apparatus before we can recommend it as a practical test for gasketing.

The tests above described are not offered as perfected procedures. The purpose in describing them at this time is to stimulate interest in this field in the hopes that, through cooperative action, wholly satisfactory methods will be worked out.

Significance of Naval Testing[1,2]

By Ellsworth F. Seaman[3]

It is an immediate and obvious conclusion that the purpose of a test is to measure the behavior of the test specimen; a more basic significance, however, provides the motivating influence when test programs rather than individual tests are objectively analyzed. It is through this approach to the real significance that the administrative and technical relationships of different kinds of Naval testing can be classified according to the more common types of testing used throughout the Naval establishment.

With the foregoing premise in mind, the following outline has been prepared:

Test Classifications

I. Technical
   (a) Research
   (b) Development
      1. Specification Development
      2. Design Development
      3. Evaluation
II. Administrative
   (a) Qualification (Type or brand approval)
   (b) Inspection
      1. At Manufacturer's Plant
         Visual
         Simple Measurements
      2. At a Government Laboratory
         More complicated measurements Identity tests

Tests relating to research represent a broad field, and are outside the scope of this discussion.

The next test classification, in its chronological sequence is that of development, which in turn may be broken down into the three categories of specification development, design development, and evaluation.

The end objective of specification development testing is to examine all available commercial products against the yardstick of minimum performance required for Naval service use and to analyze the test results to the end that an adequate specification may be prepared. The criteria for establishment of performance requirements based upon laboratory tests have two general aspects: first, that this bracket will define minimum performance needs necessary for Naval service, and, second, that this upper bracket will represent adequate availability.

Design development testing is the counterpart of the specification development testing when a particular design is being developed, but where it may embody features of a specialized nature not normally found as a product of industry. Such design models may be the product of either a Navy activity or of a commercial concern which is developing a product intended to meet the specialized requirements established for Naval use.

Evaluation testing is in a sense identical with the two preceding categories except that in this case the evaluation is an end in itself. After the general suitability of a product has been determined, it is completely evaluated in all of its characteristics in order that fingerprints of identity might be established for future reference purposes.

Qualification testing, commonly known as type or brand approval testing, has an administrative significance because tests falling under this heading require a considerable period of time for their performance and must be made under an established specificaion and prior to the purchase of the item covered by the specification. It is the basic intent of qualification testing to examine the ability of a producer to make the specific item under the specification in question and to test the performance of these products at Government laboratories. The successful conclusion of this test of a product forms the basis for the addition of the product and the producer's name to the Navy Department Acceptable List of Approved Materials, or to the Qualified Products List, where the latter is, in many cases, a joint Army-Navy-Air Force document. The legal justification for the maintenance of these lists, and a prerequisite to their establishment, is that the time required for testing is greater than is permissible for inspection tests under contract. Many of the tests represent an evaluation of the product under examination but differ from the developmental evaluation tests in that the product is examined for the purpose of comparing its performance against pre-established limits as contained in the governing specification or standard.

Inspection testing is, as its name implies, an examination of products offered to the Government under a contract. These tests may be conducted at a manufacturer's plant if they represent visual checks, or the more simple measuring techniques which normally form a part of the manufacturer's production line. In the event, however, that more intricate test techniques must be employed that are not commonly available at a manuacturer's plant, or where qualification testing is a prerequisite under the specification, it is normally required that a part of such inspection test work be conducted at a Government laboratory. An important part of contract inspection testing at a Government laboratory where a product appears on the Qualified Products List, is the identity testing which identifies the product with that which was initially tested and approved under the qualification test. This poses, in many cases, a very difficult technical problem, because shortened inspection tests must be employed which will result in positive identity, but where identity tests must not duplicate the more time-consuming qualification tests.

An important consideration in the relationship between qualification testing and inspection testing is that the qualification test initially demonstrates the manufacturer's ability to produce a product. It does not guarantee continued uniform quality, and it is therefore necessary to perform adequate inspection testing for all materials offered under contract.

The outline in Table I illustrates the basic factors inherently a part of Naval service installation condition:

Whether tests are made for development, qualification, or inspection, these are normally influenced in their definitions by the characteristics itemized in the illustration. It will be observed that the service criteria listed as performance "A" must be compared with the actual performance of commercially available material having a performance "B" which must equal or excel the minimum requirements of the applicable specification before it can be considered suitable for Naval use. In those cases where standard commercial equipment cannot be found which will meet the rigid Naval service needs, then it is essential that a nonstandard commercial product be developed as is indicated under performance "C."

The performance characteristics that have just been discussed are further classified below according to basic end consumer objectives:

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[1] The opinions or assertions contained herein are the private ones of the author and are not to be construed as official or revealing the views of the Navy Department or the naval service at large.

[2] This article contains the substance of a talk given before the American Council of Commercial Laboratories at a meeting held in the Office of Naval Research, December 2, 1948.

[3] Electrical Engineer, Bureau of Ships, Navy Dept., Washington, D.C.

TABLE I

Performance A	Performance B
Simulated or Actual Service Conditions	Service Limitations of Available Material
Expression of service Conditions and operating requirements in terms of laboratory tests 1. Life (Accelerated aging) 2. Moisture Resistance 3. Vibration and Shock Resistance 4. Heat and Flame Resistance 5. Fungus Resistance 6. High Electrical Characteristics 7. Special Functional Requirements 8. Oil Resistance 9. Space and Weight Limitations	Measurements of inherent performance of commercially available equipment and material in terms of

When $\frac{B}{A} < 1$ Research is necessary

Performance C

Equipment and material falling initially in Classification B but modified as a result of research and development to fill the needs of naval shipboard requirements.

SERVICE CONDITIONS NATURAL ENVIRONMENT
- Corrosive action of the elements
- Stresses and strains incident to seaway
- Deleterious action of high humidity and moisture

SERVICE CONDITIONS OPERATIONAL ENVIRONMENT
- Shock
- Vibration
- Inclined operation
- High temperatures

PROTECTION OF PERSONNEL AND MATÉRIEL
- Safety
- Flame resistance
- Explosion resistance

INSTALLATION, OPERATION, AND MAINTENANCE
- Economy of operation and maintenance
- Interchangeability
  - As a unit
  - By spare parts
- Reliability
- Simplicity
- Smallest size and lowest weight

Simulative service testing presents the problems of accurately reproducing in the laboratory the environmental service conditions which are encountered in the field. In the case of nature environment, materials and equipment must be tested to measure their resistance to the corrosive action of the elements, stresses, and strains incident to seaway, and the deleterious action of high humidity and moisture. On two of these three characteristics, conditioning or cycling cabinets are necessary. In this connection it can be stated that the problem of adequate cabinets for conditioning purposes has been very frequently a limiting factor in handling laboratory tests.

The growing recognition of the value of and need for more simulative service testing in industry has been reflected by studies on this subject made by Committees of the American Society for Testing Materials. The successful standardization and common use of any part of the simulative service test program must necessarily be accompanied by greater availability of such test equipment in commercial and Government laboratories. As a Naval example* of this kind of testing, laboratory tests of metals and alloys employing synthetic saline solutions do not simulate service conditions, and a laboratory has been established at a location where live, clear, sea water is available. This laboratory has been equipped with apparatus in which samples may be exposed to the erosive effect of sea water at various velocities and temperatures, thus simulating conditions met in actual service.

The tests under way at the Tropical Exposure Station in Ft. Sherman, Panama, are further examples of the development of laboratory testing more simulative of actual service. Various types of equipment and materials are exposed in this test station, under actual jungle conditions, and periodic tests are made to measure the deteriorative effect of tropical environment.

The environmental conditions incident to service on the operational basis are those things which are created by the type of installation involved. In other words, the propeller rotation in a plane or ship, as well as rotating machinery auxiliaries, produces vibration. Firing of guns produces a shock of extreme magnitude. The type of vessel concerned determines, to a large extent, the degree of inclined operation that must be expected, although the extreme condition is normally assumed at being between 30 and 45 deg. High temperatures may be created by compartment operating conditions, or by individual equipment enclosures which do not permit rapid heat dissipation.

The protection of personnel and matériel influences to a large degree certain of the test requirements which must be provided in Naval laboratories. In order to meet these demands a variety of flame tests have been devised to determine whether different products are flame resistant. The explosion-proof tests are also conducted in order to insure safety of operation of spark-producing equipment in spaces containing explosive vapors.

From the standpoint of installation, operation, and maintenance, the factors which are itemized are probably self-explanatory and, except for interchangeability and least size and weight, find their counterpart in that testing which is necessary for industry.

It is hoped that the foregoing will in some measure contribute to a better understanding of the reason for specialized test requirements and associated special test equipment, many times required for the evaluation of products intended for Naval use.

* Acknowledgment. This example was suggested by Mr. K. D. Williams, Metallurgical Engineer, Bureau of Ships, who has directed the Kure Beach, North Carolina, sea water-corrosion study.

Thixotropic Strength Regain of Clays*

By Louis Berger[1] and John Gnaedinger[2]

SYNOPSIS

Most natural clays lose a very substantial part of their strength when remolded. This characteristic loss of strength with remolding also occurs in slurries containing montmorillonite clay, except that the slurries appear to regain most of their original strength with the passage of time. No data have been published to indicate whether natural clays at moisture contents below the liquid limit would ever regain strength in sufficient amount to warrant consideration of this property in engineering design.

In this investigation, several large samples of clay, for which considerable data regarding natural strength were available, were completely remolded, moisture sealed, and stored under water. At various intervals over a period of one year, specimens were tested in unconfined compression and in consolidation to determine the effect of time on the physical properties. The purpose of this investigation is to determine whether the properties of clay soils which had been remolded were altered with the passage of time.

EXISTING DATA ON THIXOTROPY

MANY published reports indicate that dilute suspensions and slurries of montmorillonite clay when once disturbed regain their original shearing strength with the passage of time. This phenomenon of strength regain with time is known as thixotropy and has been described by Freundlich[3]. No data have been published concerning observations on the properties of clays remolded at water contents below the liquid limit, which would represent the densities of clay encountered under normal engineering conditions. Oreste Moretto[4] has described four cases where substantial strength increases were observed relatively short times after the clays were remolded.

MATERIALS AND PROCEDURES

The clays studied in this investigation were obtained from Grand Forks, N. D., and Crookston, Minn. Both are sedimentary materials of glacial origin from the site of the glacial Lake Agassiz taken from depths 50 ft. or more below the present ground surface. The physical properties of the undisturbed materials, based on the results of a large number of tests, are presented in Table I. Large undisturbed samples of these clays were completely remolded, prepared in specimen sizes, sealed with paraffin against moisture loss, and stored under water to insure that there would be no change in water content during storage. The specimens intended for unconfined compressive strength tests were made 2.8 cm. in diameter by 6.0 cm. high. Specimens 14 cm. in diameter and 5 cm. high were prepared for testing in the consolidometer.

It was originally anticipated that the compressive strengths indicated by the tests of these remolded specimens would depend to a minor extent on the length of time each specimen was remolded; to a major extent on the water content of the specimen at the time of the test; and to some intermediate extent on time of storage after remolding. Since changes caused by time of storage were believed to be the primary indication of the thixotropy, the following procedures were followed in an effort to eliminate the other variables. Samples of Crookston clay were remolded for periods of $\frac{1}{2}$ min. to 8 min. and compressive strengths determined from unconfined compressive tests. Since the remolding time varied, the drying out of each sample varied slightly, in proportion to the time of kneading. Despite this slight variation in moisture content, there was so little difference in the compressive strength test that it was considered fairly conclusive that time of remolding was a minor variable and could be practically eliminated if all specimens were remolded for approximately the same length of time.

Previous tests had indicated that samples sealed in paraffin and stored in a humid room for long periods would undergo some reduction in moisture content in proportion to storage time. It was also known that, for the materials being studied, partial drying out would cause a large apparent strength increase which would completely obscure the strength increase, if any, resulting from thixotropy. To eliminate this condition, each specimen was given several coats of paraffin with a cumulative thickness of from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. The Crookston samples were, in addition, sealed in cellophane tubes before application of the paraffin coating. It was believed that this sealing procedure, plus continued storage under water, would eliminate any possible strength increases due to dehydration.

WATER CONTENT CHANGES AND CORRECTIONS

The sealing and storage procedures were completely successful in preventing dehydration of the specimens. However, the specimens unexpectedly absorbed water through the paraffin coating. The magnitude of water content increases were as great as 4 per cent for the Crookston clay and 6 to 8 per cent for the Grand Forks clay.

If a relationship could be established between water content and compressive strength that was independent of storage time, it would permit the correction of all tests results for variations resulting from changes in water content. Such a relationship would also permit reduction of all compressive strengths to the same water content as the initial undisturbed specimens. P. C. Rutledge[5] established the fact that such a relationship does exist. The data presented in Fig. 4 for undisturbed Grand Forks clay are based on his results. Similar tests on remolded clays from Grand Forks and Crookston indicate the same exponential relationship, which is presented in Figs. 1 and 4. Using these figures, all of the data for Grand Forks clay were corrected to a water content of 67 per cent and for Crookston clay to a water content of 37.7 per cent. These values correspond to the initial natural water content of each sample.

RESULTS OF COMPRESSIVE STRENGTH TESTS

Crookston Clay.—Two series of compressive strength tests were performed on specimens of Crookston clay. In the first series, the time of remolding was varied from 0.5 min. to 8 min. and the specimens were tested immediately after remolding and forming. In the second series, clay for all specimens was remolded for 4 min., specimens were formed, sealed, and stored under water

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* Presented at a meeting of Committee D-18 on Soils for Engineering Purposes, held in Atlantic City, N. J., June 29, 1949, during the Fifty-Second Annual Meeting of the Society.

[1] Lecturer in Civil Engineering, Northwestern University, Evanston, Ill.

[2] Partner, Soil Testing Services, Evanston, Ill.

[3] P. Freundlich, "Thixotropy," Herman & Cie., Paris (1935).

[4] Oreste Moretto, "Effect of Natural Hardening on the Unconfined Compressive Strength of Remolded Clays," *Proceedings*, Second Int. Conf. Soil Mechanics, Vol. 1, June, 1948, pp. 137–144.

[5] P. C. Rutledge, Report on Investigation of Foundation Conditions for Northern States at Grand Falls, North Dakota March 28, 1947; unpublished.

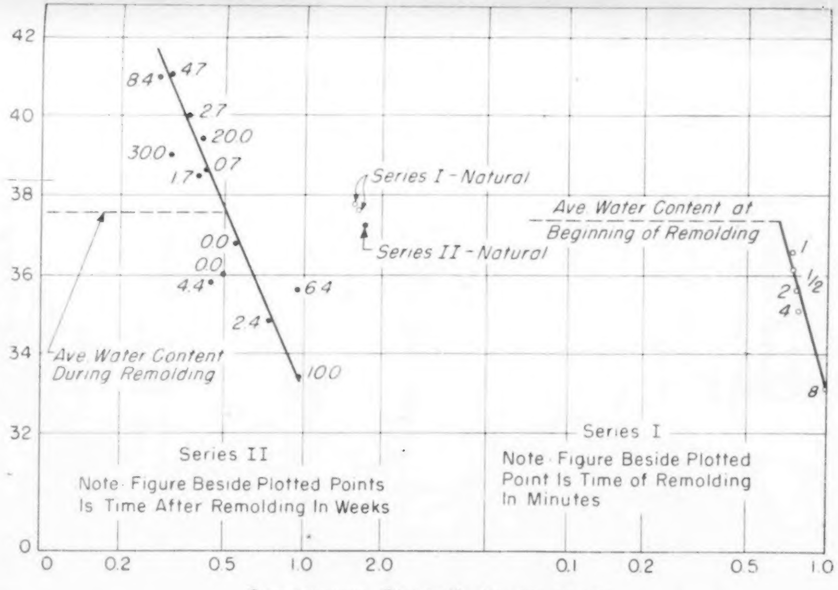

Fig. 1.—Water Content *versus* Unconfined Compressive Strength, Crookston, Minn., Series I and II.

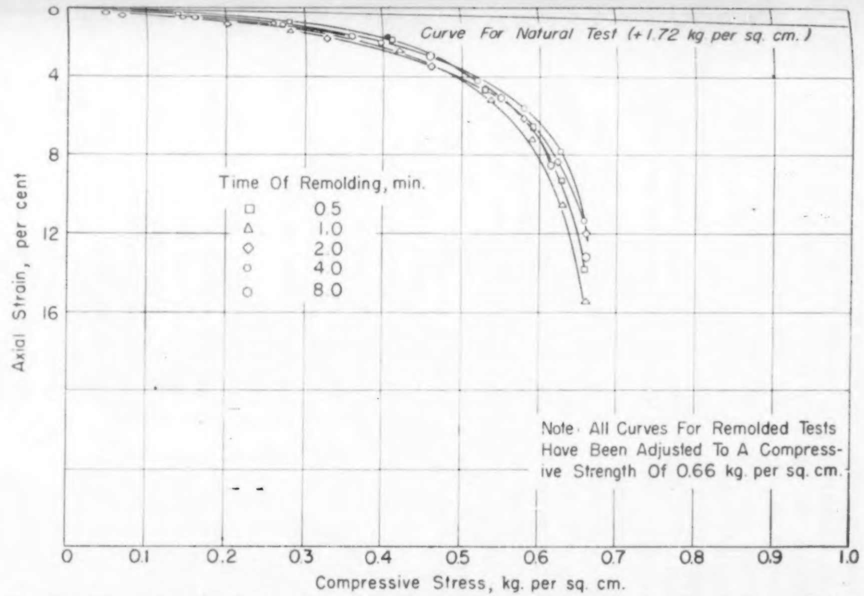

Fig. 2.—Stress-Strain Curves for Unconfined Compression Tests, Crookston, Minn., Clay. Series I.

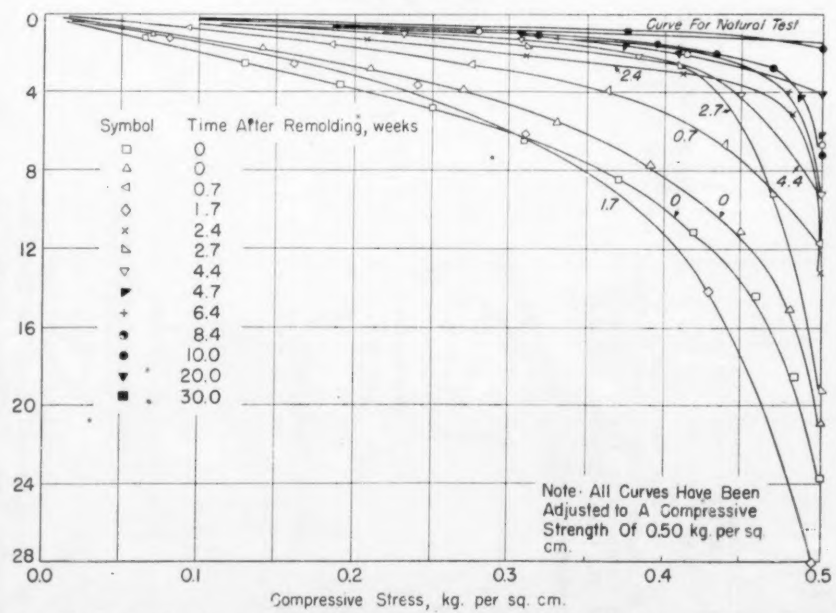

Fig. 3.—Stress-Strain Curves Unconfined Compression Tests, Crookston, Minn., Clay. Series II.

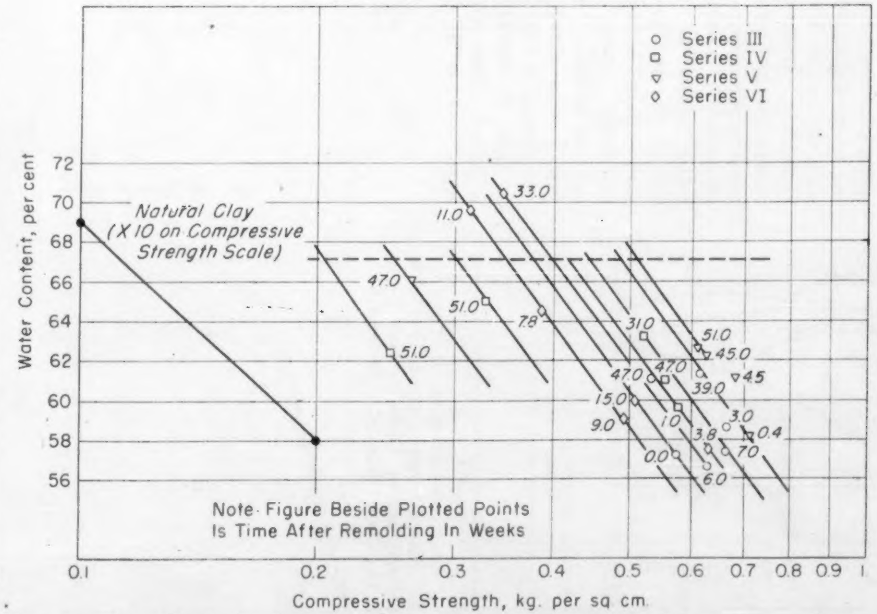

Fig. 4.—Water Content *versus* Unconfined Compressive Strength Grand Forks, N. D., Clay.

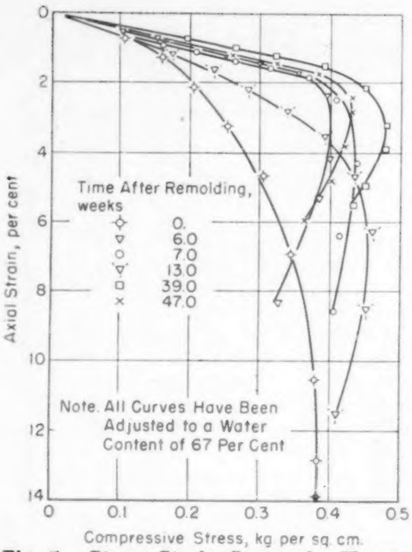

Fig. 5.—Stress-Strain Curves for Unconfined Compression Tests, Grand Forks, N. D., Clay. B16-S8. Series III.

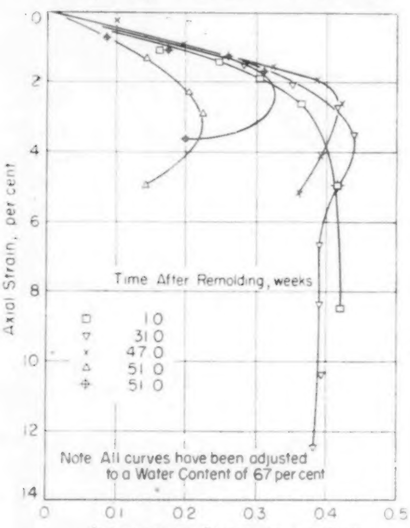

Fig. 6.—Stress-Strain Curves for Unconfined Compression Tests, Grand Forks, N. D., Clay. B16-S8. Series IV.

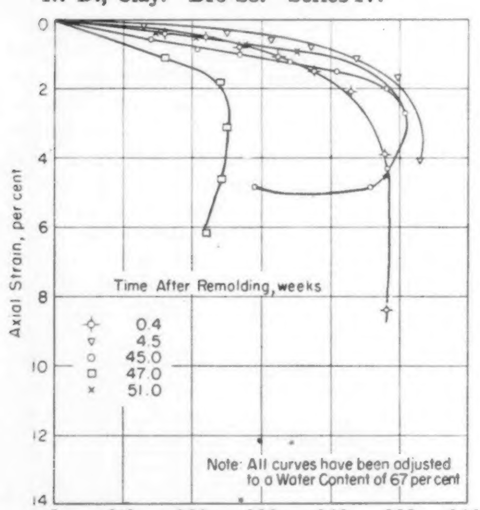

Fig. 7.—Stress-Strain Curves for Unconfined Compression Tests Thixotropy, Grand Forks, N. D., Clay. B16-S8. Series V.

for testing after different intervals of storage. In Fig. 1 the compressive strengths from both series are plotted against water content at end of test. In series I the only effect of time of remolding on strength resulted from a progressive drying of the specimens during remolding. In series II there is no consistent effect of time of storage on compressive strength. The only consistent effect is the variation of strength with water content at end of test. For this reason, the results of all tests in both series were adjusted to compressive strengths corresponding to the water content at time of remolding. The adjusted stress-strain curves for series I are plotted in Fig. 2 and show no effect of time of remolding. In Fig. 3, the adjusted stress-strain curves for the tests in series II show a marked and

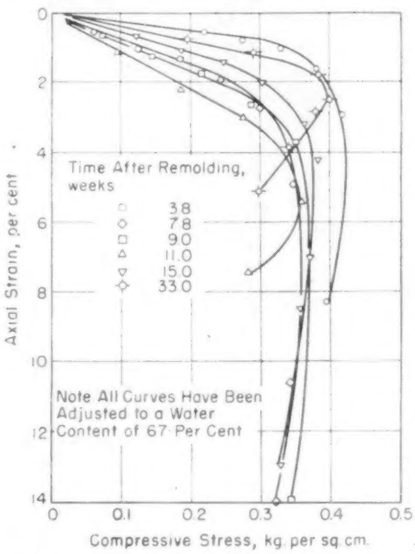

Fig. 8.—Stress-Strain Curves for Unconfined Compression Tests, Grand Forks, N. D., Clay. B16-S8. Series VI.

reasonably consistent variation with time of storage, the clay gradually changing from a highly plastic to a fairly brittle material in the 30-week storage period.

Grand Forks Clay.—One large batch of this black, slickensided, highly plastic clay was originally remolded from sample No. B16-S8. Because of the time required to mold, shape, and seal each of the 28 test specimens prepared, the large batch was split into four parts. Test specimens were prepared on successive days from each of the four parts by remolding and mixing that part immediately before molding the specimens. It was believed that the original mixing of the entire batch followed by remolding of each part before making the specimens would result in all specimens being initially the same. As the testing progressed it seemed likely that some of the strength differences observed were due to differences between specimens molded on different days. Therefore, the data have been separated into four series corresponding to the four groups of specimens.

Compressive strength *versus* water content at end of test results for the tests on Grand Forks clay are shown in Fig. 4. Because of the large variations in final water contents, all test results have been adjusted to the remolding water content of 67 per cent. The slopes of the lines in Fig. 4 indicate the method and magnitude of the adjustments. All other stress values for the stress-strain curves were adjusted by direct proportion for each test. The adjusted stress-strain curves for the four test series are shown in Figs. 5, 6, 7, and 8.

Specimens of Grand Forks clay tested during the first 40 weeks of storage

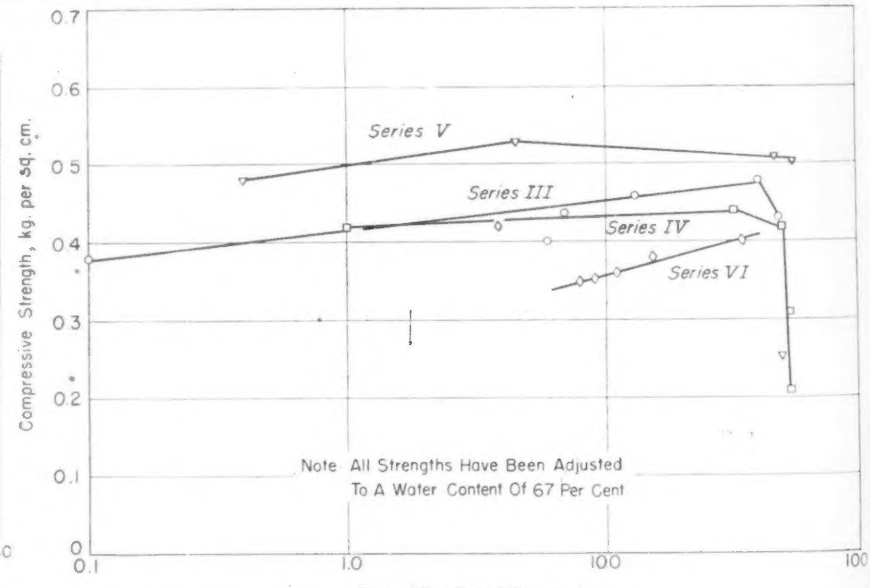

Fig. 9.—Compressive Strength *versus* Time After Remolding, Grand Forks, N. D., Clay. B16-S8.

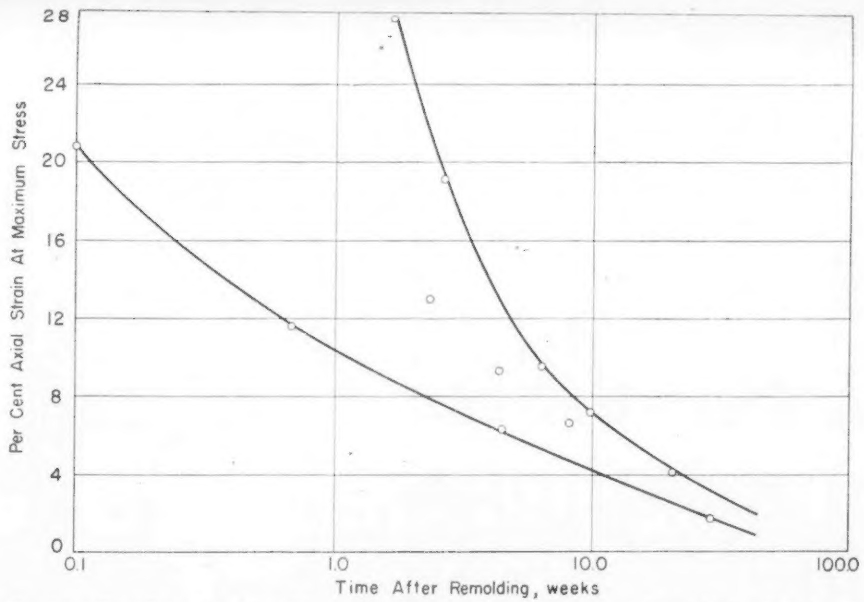

Fig. 10.—Per Cent Strain at Maximum Stress *versus* Time After Remolding, Crookston, Minn., Clay. Series II.

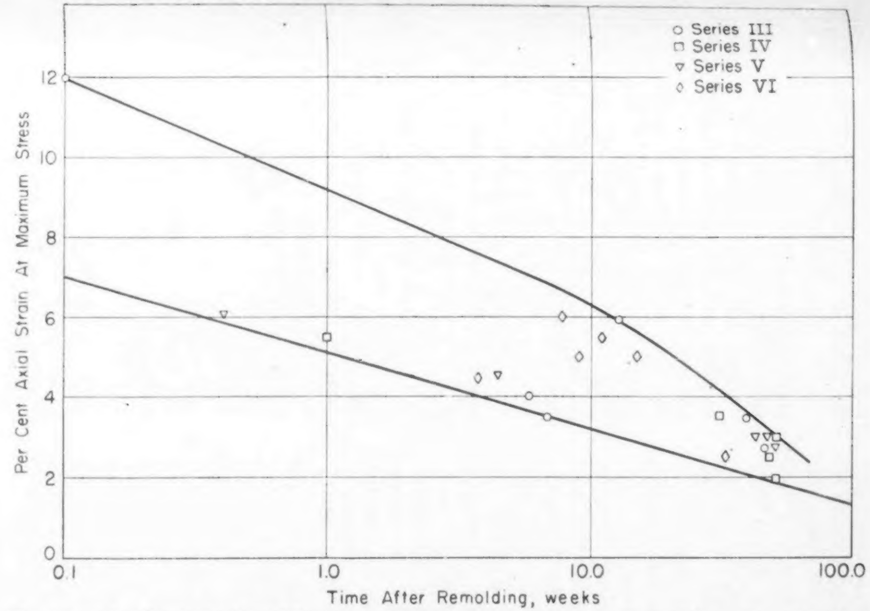

Fig. 11.—Per Cent Strain at Maximum Stress *versus* Time After Remolding, Grand Forks, N. D., Clay. B16-S8.

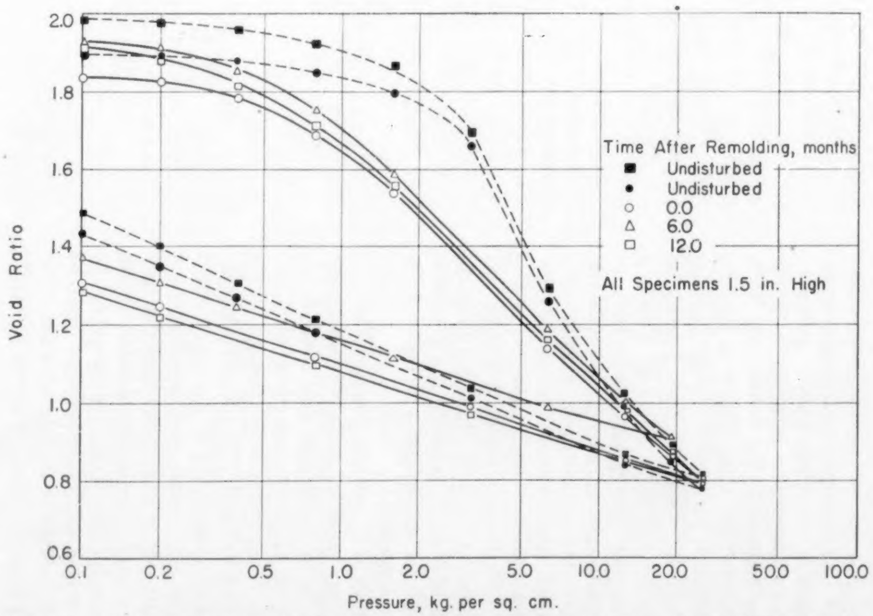

Fig. 12.—Pressure-Void Ratio Curves for Thixotropy Investigation, Grand Forks, N. D., Remolded Clay. B16-S7.

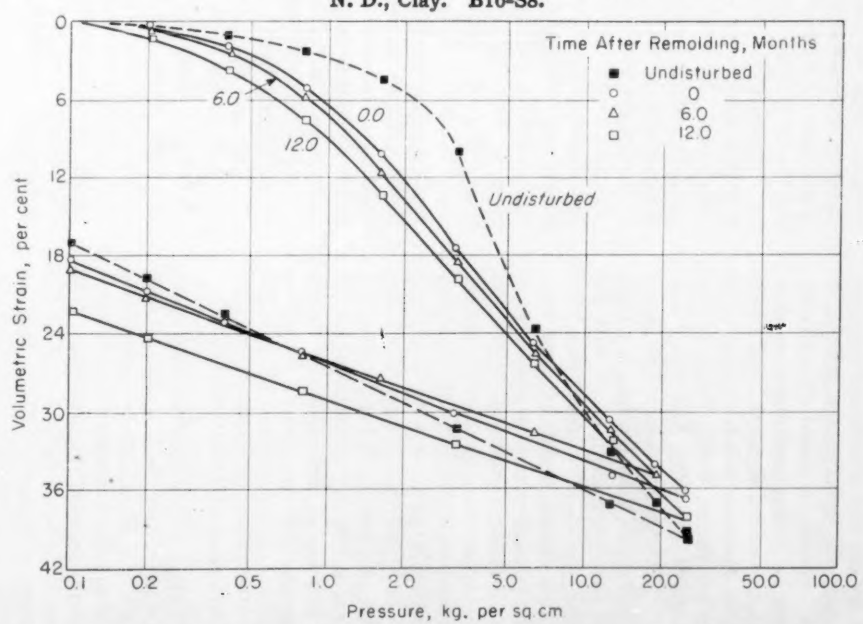

Fig. 13.—Pressure-Volumetric Strain Curves Thixotropy Investigation, Grand Fork, N. D., Remolded Clay. B16-S7.

after remolding showed consistent although small increases in strength, as shown by the plot of adjusted compressive strength *versus* water content in Fig. 9. Specimens tested after this 40-week period had elapsed began to show lower compressive strengths and a considerable increase in brittleness. The brittle specimens, which failed at low compressive strengths, had many hair cracks. The failures occurred on planes passing through these cracks, giving test results that were inconsistent with the previous trend. The development of these hair cracks, and the loss in compressive strength after 40 weeks' storage, has not been satisfactorily explained and does not appear to be entirely compatible with either observations of the behavior of this clay in nature or with theoretical concepts. The cracks and strength loss may be an experimental error resulting from expansion of the specimens due to their increase in water content during storage under water.

Discussion of Results of Compressive Strength Tests

Strength.—The Crookston clay in its natural condition had a compressive strength of 1.70 kg. per sq. cm. After remolding, its strength at the same water content was approximately 0.51 kg. per sq. cm. or 30 per cent of the undisturbed strength. There was no indication of any thixotropic increase in strength with time. The average undisturbed strength of the Grand Forks clay in 1.4-in. diameter specimens was 0.93 kg. per sq. cm. at a natural water content of 73.2 per cent and 1.10 kg. per sq. cm. at the remolding water content of 67 per cent. The average strength of the remolded clay within the first week after remolding was 0.42 kg. per sq. cm. or 37 per cent of the undisturbed strength for identical sized specimens and water content. After 40 weeks of storage the average strength had increased to 0.48 kg. per sq. cm. or 44 per cent of the undisturbed strength for identical conditions. The major feature of the strength results for the Grand Forks clay, shown in Fig. 9, was the rapid decrease in strength after 40 weeks of storage, possibly due to expansion of the specimens with increase in water content.

Strain at Maximum Stress.—The outstanding result of these tests was the increase in brittleness and decrease in strain at maximum stress for all specimens with increasing storage time. The test values for strain at maximum stress and the range of values obtained for the Crookston clay are shown in Fig. 10. It will be noted that this clay was highly plastic immediately after remolding with strains in excess of 20 per cent at maximum stress. After 30 weeks the failure strain was of the order of 2 per cent. Also, as shown in Fig. 3, the modulus of deformation increased consistently with increasing storage time and after 30 weeks was essentially equal to the modulus of deformation of the undisturbed clay. Similar data for the Grand Forks clay are shown in Fig. 11. This material was less plastic than the Crookston clay immediately after remolding. After 51 weeks of storage the failure strain was of the order of 2 to 3 per cent or practically as small as the values for the undisturbed clay.

General.—At the beginning of this investigation it was believed that any thixotropic changes in strength properties would depend on the quantity and type of colloidal clay present in the soils. For this reason the Crookston and Grand Forks clays, both of which contain considerable quantities of montmorillonite, were selected for the investigation. It was also expected that the plasticity limits might prove to be a measure of possible thixotropic effects. As listed in Table I, both clays are highly plastic, but the liquid limit of 110 per cent and the plasticity index of 70 per cent of the Grand Forks clay are almost double the values for the Crookston clay. Some thixotropic increase in strength did occur in the Grand Forks clay but the increase was practically insignificant compared with the original undisturbed strength. The strain effect in both clays were essentially the same.

Results of Consolidation Tests

To investigate the effects of thixotropy on consolidation test results, a large batch of Grand Forks clay from a sample immediately above that used for the compressive strength tests was remolded. One specimen was molded immediately into a consolidation device specimen ring and tested in consolidation. Three other specimens were molded into glass crystallizing dishes covered with glass plates sealed on with paraffin and stored under water for future testing. These specimens were approximately one inch larger in diameter and thickness than the consolidation test specimen. When prepared for test, the glass dish was broken into small pieces and removed from the specimen which was then trimmed to test size by the methods used for undisturbed samples. Specimens have been tested after 6 and 12 months' storage and one specimen remains to be tested at 30 months after remolding (in May, 1949). The pressure-void ratio curves resulting from the tests to date, with curves for tests on undisturbed specimens, are shown in Fig. 12. In spite of careful and complete remolding, the initial water contents and void ratios of the remolded specimens were not as uniform as anticipated. The results have therefore been plotted in terms of volumetric strain in Fig. 13. Neither figure shows any significant thixotropic effect on the consolidation test compression curve for the remolded clay resulting from 12 months' storage.

Conclusions

1. The thixotropic increase in compressive strength with time, for the soils studied, was not of sufficient magnitude to be of any practical importance.

2. All specimens showed a marked increase in brittleness and decrease in the per cent of axial strain at maximum stress with increasing storage time.

3. A 12-month period of storage had no appreciable effect on the pressure-void ratio characteristics of the remolded specimens.

Acknowledgments:

All tests reported herein were performed in the Soil Mechanics Laboratory of the Technological Institute, Northwestern University, under the general supervision of Professors P. C. Rutledge and J. O. Osterberg. The samples of clay from Grand Forks, N. D., were obtained through the courtesy of Mr. Hibbert M. Hill, Hydraulic Engineer, Northern States Power Co., Minneapolis, Minn. The samples of clay from Crookston, Minn., were obtained through the courtesy of Mr. Cyrus G. Wright, Vice-President, and Mr. G. W. Welch, Chief Engineer, Otter Tail Power Co., Fergus Falls, Minn. The consolidation tests for the zero and six months' storage periods were made by Mr. T. W. Van Zelst. The authors also express their special appreciation to Professor P. C. Rutledge for his many suggestions and encouragement during the progress of the study and in the preparation of this paper.

TABLE I.—PHYSICAL PROPERTIES OF CLAYS USED IN TESTS.

	Grand Forks Clay[a]		Crookston[b]
	B16-S7	B16-S8	
Description	Black, slickensided clay		Blue clay
Natural water content, per cent	74.3	73.2	37.5
Liquid limit, per cent	102.0	110.7	60.0
Plastic limit, per cent	39.0	40.7	25.0
Plasticity index, per cent	63.0	70.0	35.0
Preconsolidation range, kg. per sq. cm.	2.2 to 2.8	2.5 to 3.2	1.6 to 2.5
Compressive strength, kg. per sq. cm.	1.01	0.93	1.70
Strain at maximum strength, per cent	2.8	1.7	8.0
Modulus of deformation, kg. per sq. cm.	64	52	37
Specific gravity	2.70	2.68	2.73

[a] P. C. Rutledge, "Report on Investigation of Foundation Conditions for Northern States Power Co., Plant at Grand Forks, N. D." Unpublished report, March 28, 1947.
[b] T. W. Van Zelst, "An Investigation of the Factors Affecting Laboratory Consolidation of Clay," *Proceedings*, Int. Conf. on Soil Mech. Vol. 7 (1948).

Medical X-Ray Protection up to Two Million Volts

The increasing use of high-energy X-rays in medical diagnosis and treatment has presented new problems in all phases of radiation protection and shielding. Recommended standards of safety for the installation and use of high-voltage X-ray equipment are concisely set forth in a new handbook, *Medical X-ray Protection up to Two Million Volts*, published by the National Bureau of Standards.

This handbook was written by a subcommittee of the National Committee on Radiation Protection. It contains instructions for meeting presently accepted standards as well as advisory recommendations that should be applied where possible. Rules are given for working conditions, survey and inspection of installations, planning an X-ray installation, structural details of protective barriers, and specific types of installations. A chapter on electrical protection treats such topics as high-voltage circuits, grounding inspection and maintenance, warnings and instructions, and first-aid and fire-extinguishing devices. Also included are tables and graphs for determining the requirements of protective barriers and distance protection in specific cases.

This 49-page Handbook 41 is obtainable at 15 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Atomic Energy Commission Annouces Distribution Program for Cyclotron-Produced Radioisotopes

Cyclotron-produced radioisotopes will be made available to research men in the United States under a partially subsidized program announced recently by the Atomic Energy Commission. With this additional supply, researchers will have a new collection of tools for finding answers to problems in science and industry. The cyclotron produces these radioisotopes by bombarding material with electrically charged subatomic particles, which are accelerated to extremely high energies by successive electrical impulses in a magnetic field.

The program will augment the present distribution of reactor-produced radioisotopes which has been in effect since August, 1946. The nuclear reactor or pile produces radioisotopes by means of fission of uranium nuclei and by the bombardment of material by the resulting electrically uncharged subatomic particles, neutrons. Up to the present, some 7000 shipments of radioisotopes of nearly 60 elements representing nearly 100 isotopic species have been made for research purposes.

Only those cyclotron-produced isotopes having half-lives of more than 30 days will be distributed initially. Included in these valuable research tools are 43-day beryllium 7, 3-year sodium 22, 44-day iron 59, 4-year iron 55, 250-day zinc 65, 90-day arsenic 63, and 56-day iodine 125.

Under the distribution arrangements, the Carbide and Carbon Chemicals Corp., operator of the Oak Ridge National Laboratory for the Commission, will be authorized to purchase cyclotron time from various institutions operating such machines.

Although the uranium chain-reacting reactor far surpasses the cyclotron in quantity production of radioisotopes created by fission and by certain other neutron reactions, a considerable number of important isotopes cannot be produced with the reactor. The cyclotron is a necessary and vital complement to the reactor for supplying tracer isotopes because of the wide variety of nuclear reactions it can produce.

Processing of irradiated targets will be carried out by the Oak Ridge National Laboratory in facilities already provided for handling reactor-produced isotopes. The Isotopes Division of the Commission will carry out the allocation function in the same manner as it now does with reactor-produced isotopes.

The distribution of materials produced under this program will be limited to institutions and organizations within the United States and its territories and possessions. Cyclotron-produced isotopes are more readily available abroad than reactor-produced isotopes because cyclotrons are in operation in many countries.

Radioantimony-beryllium neutron sources.—Oak Ridge National Laboratory has developed a relatively inexpensive radioantimony-beryllium neutron source which is now available for distribution to users in the United States. The sources use a core of 32 g. of antimony metal surrounded by a $\frac{3}{16}$-in. thick beryllium metal cup, the assembly being enclosed in an aluminum jacket.

The entire unit is placed in the pile and the antimony activated to the desired level.

The shipping container for the source will weigh approximately 350 lb. and should be returned to Oak Ridge National Laboratory within three weeks after date of shipment. A customer will have to make arrangements beforehand to provide a suitable storage space for the source; a lead pig with walls four inches thick would probably be sufficient.

It is planned to charge for the source and the irradiation separately, thus allowing the requestor to choose one, two or more months' irradiation time. The itemized costs of the source are as follows:

Antimony-beryllium Source, $44; Service Irradiation of Source, $43 per month; Returnable Deposit on Container, $400.

News of Instrument Companies and Personnel

James F. Ryley, Eastern Sales Representative for the Scientific Division of Kimble Glass, Division of Owens-Illinois Glass Co., has been transferred to the Toledo General Office of the company.

As of August 1 the new name of Burrell Technical Supply Co., Pittsburgh, Pa., will be Burrell Corporation.

R. H. Bacon has been elected President of the Chicago Technical Societies Council for 1949–1950. He is Vice-President of the Industrial Advertising Agency of Kreicker & Meloan, Inc., and President of R. H. Bacon & Co., Business Paper Editorial Service. The Chicago Technical Societies Council is made up of some 50 scientific, engineering, and technological societies representing approximately 18,000 members.

At the most recent meeting of the Board of Directors, of Taylor Instrument Cos., Rochester, N. Y., George H. Taylor, formerly Assistant Secretary, was elevated to the office of Secretary. He takes the post left vacant by the death of Henry W. Kimmel. Taking Mr. Taylor's place as Assistant Secretary is Rodney C. Mertz, Director and Company Attorney.

The Board of Directors of the Taylor Instrument Cos. of Canada Ltd. met July 19 in Toronto, Ontario, and elected Herbert J. Noble, Executive Vice-President and Treasurer of the parent company, a Director and the new President and Treasurer. These offices were formerly held by the late Henry W. Kimmel.

William H. Corwin has been appointed Public Relations Director of Taylor Instrument Cos., Rochester, N. Y. He joined the organization in 1942 as a member of the Advertising Department, and since 1943 has edited the company's publication "The Taylor Meteor" as well as prepared other company literature.

Kenneth E. Reynolds has been appointed Manager of Analytical Instrument Sales as Bausch & Lomb Optical Co., succeeding Charles C. Nitchie, who has retired after 19 years with the optical firm. Mr. Reynolds is an authority on aerial mapping techniques, and was in charge of special work involving equipment during World War II. Since 1947 he has been Assistant Manager of the Bausch & Lomb Photographic Lens Sales Department. Mr. Nitchie, an expert in the field of spectrography, is quite active in the work of various groups including A.S.T.M. where he rendered valuable service on Committee E-2 on Spectrographic Analysis.

Special Die Casting Machine for Research and Instruction

The Doehler-Jarvis Corp. has recently given a special die-casting machine to the Massachusetts Institute of Technology, and another to the Illinois Institute of Technology. The machine is especially made for use in instruction and research. Other institutions are to get similar machines. At Illinois Tech the machine will be used "for research in developing new alloys for casting dies and improving and developing alloys that are now used to make dies."